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ADHESIVES AGE

MANUFACTURE, APPLICATION, TECHNOLOGY, RESEARCH AND MARKETING

JULY, 1960

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Vol. 3
no. 7

UNIVERSITY OF MICHIGAN
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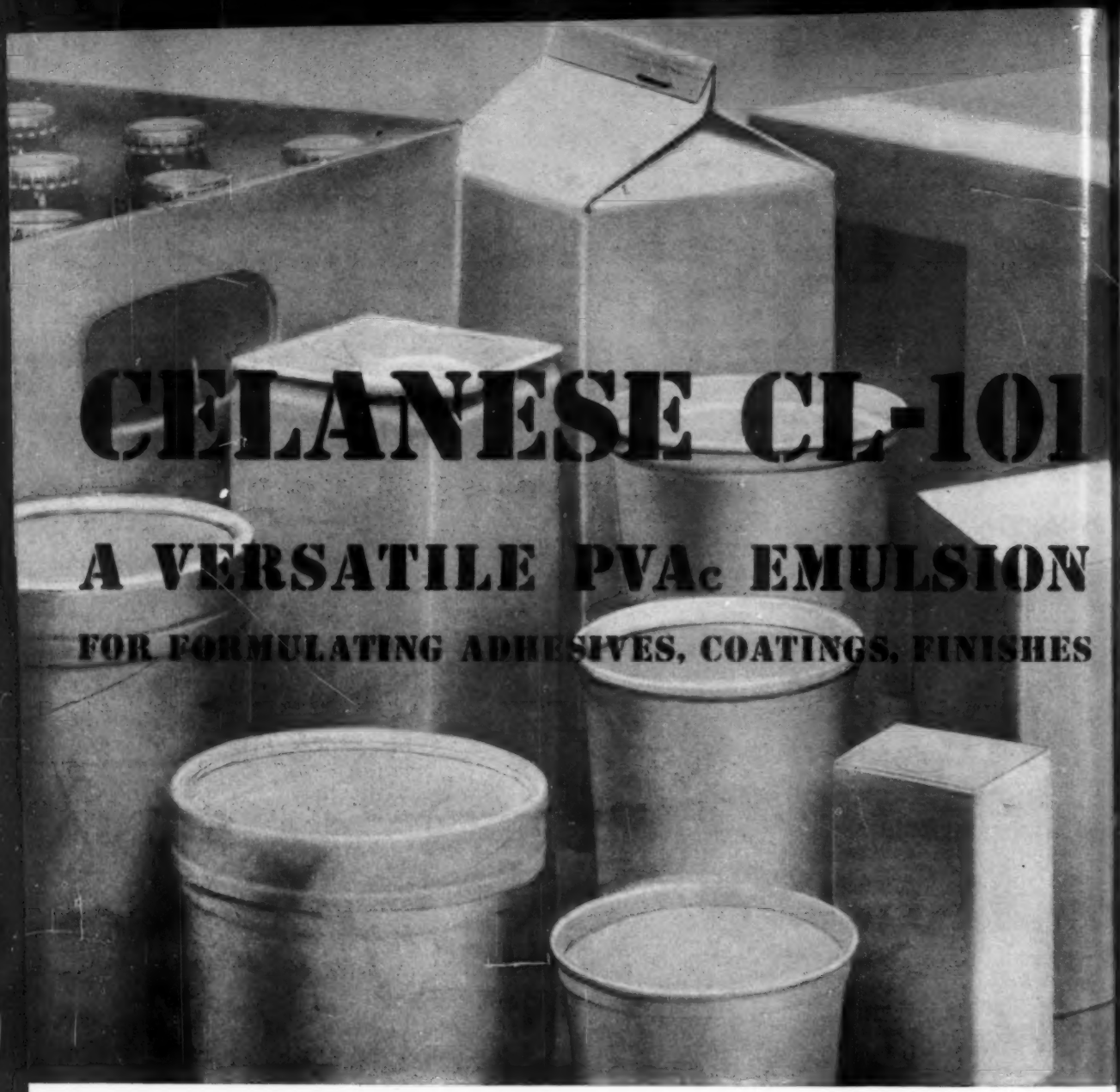
adhesive standards stimulate new uses for wood



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A fast bonding liquid adhesive primarily formulated to rapidly bond Mylar film, metallized Mylar sheeting, decorative plastic sheeting; thin gauge rigid and flexible vinyl sheeting to metal, or plastic surfaces. Vinyl-backed, decorative metallized Mylar can be tightly adhered to chromate primed or clean metal surfaces to provide wear resistance and decorative effect. Material can be easily applied with brush or spray.

Type: Synthetic Rubber
Color: Tan
Solids: 18%
Coverage: 350 sq. ft./Gal.
Wet Weight/Gal: 7.1 lbs./Gal.
Shelf Life: 6 months

Vehicle: Stabond "A" Thinner
Temp. Limits: –60° to 350°F.
Consistency: Light Liquid
Tack Period: 2-12 minutes
Flammable: Yes
Toxicity: Semi
Application: Brush or Spray

STABOND C-143

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Solids: 20%
Coverage: 350 sq. ft./Gal.
Wet Weight/Gal: 7.1 lbs./Gal.
Shelf Life: 6 months

Vehicle: Stabond "A" Thinner
Temp. Limits: –60° to 350°F.
Consistency: Light Liquid
Tack Period: 2-12 minutes
Flammable: Yes
Toxicity: Semi
Application: Brush or dip.

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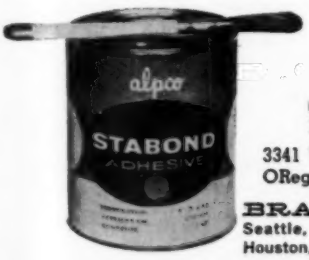

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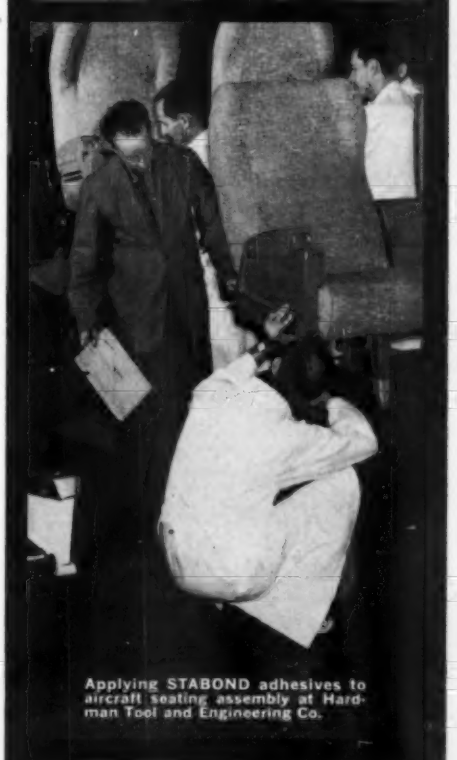

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ADHESIVES AGE

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The dramatic photograph showing the use of laminated structural wood beams in building construction is matched in excitement by the news that recent adhesives and adhesive techniques have led to the "rediscovery" of wood as a structural material. The article beginning on page 22 tells how the perfection of standards has contributed to this new development in the industrial picture. The photo is used by courtesy of Unit Structures, Inc., Peshtigo, Wisc.

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PP PALMERTON PUBLISHING CO., INC.

JULY, 1960
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TV and Adhesives Too

The other night, while watching a popular television program, references to adhesives were made in an off-hand way, references which suggested a condition to be explored. It seems that a representative from the British Exhibition held at the New York Coliseum, in an appearance on the television show, exhibited what was said to be the first sheet of postage stamps ever made. Produced in England in 1840, these "penny" stamps were not perforated so that the user had to cut each stamp from the sheet with a pair of scissors. However, the stamps were backed with an adhesive.

The television master of ceremonies observed that the adhesive probably tasted poorly and went on to say that there had not been any noticeable improvement in these matters even now. Of course, we cannot argue this matter of "taste," nor will we attribute any devious motive to the master of ceremonies.

The situation, however, points up the fact that the adhesive industry, as an industry, has a lot of educating to do. Many people do not know that steps have been taken by many companies to improve the "taste" of adhesives. Envelope manufacturers, in particular, have been and are doing much work in this direction.

As it happens, when a citizen of the United States wishes to mail a letter he can only buy his stamps from one store. He cannot buy the proverbial "brand X," nor can he request "the peppermint flavored kind." The citizen of the United States should know, however, that the adhesives industry does not make bad tasting glues deliberately; he should know that the industry is spending time and money in solving its problems, and, in essence, he should know more about us and what we do.

At last count there are some fourteen separate organizations in this country devoting themselves to adhesives or some aspect of the adhesives industry. None of these groups have taken upon themselves to speak for the industry in an institutional manner. There is no concentrated program for educating the public. This, we believe, is a severe lack. The way to build markets, the way to create customer satisfaction—comes first through education. The steel industry, the oil industry, the rubber industry and others do good jobs in this direction. We seem to be doing nothing.

We would suggest that the officers of the fourteen groups arrange some method of communication with each other for a mutual exploration of the educational problem. For its part, ADHESIVES AGE, will do all it can to help. We would be interested in hearing from our readers on this matter.

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CONSULTANT'S CORNER

By Dr. Irving Skeist

Cardboard to Vinyl

Question: Our bathroom hampers are made with a Homosote (porous board made from ground newspaper) lid covered with a vinyl plastic on top and over the edges. A cardboard back is nailed on to cover the edge of the trimmed vinyl.

It would make a much nicer job if this cardboard could be glued on, but we have not found a satisfactory contact glue. No difficulty is encountered in gluing the cardboard to the Homosote, but we have had trouble with the areas where the cardboard has to bond to the vinyl. Can you make a recommendation for handling this job?

Answer: A nitrile rubber solvent cement should give adequate adhesion to the vinyl plastic sheeting. Adhesion to the cardboard is no problem. Coat both vinyl and cardboard, and mate them when enough solvent has evaporated to leave the surfaces tacky. *Q-153*

Graphite to Oily Bronze

Question: We would like to cement together a bronze washer and graphite. These pieces are approximately one-inch in diameter and the surfaces in contact would be extremely flat and smooth. They operate between 50° and 250°F.

We have not attempted to tackle the problem since we are somewhat afraid of trying to bond to the bronze part which is impregnated with a certain amount of oil. Do you have any suggestions?

Answer: A rigid epoxy composition should be satisfactory. A liquid expoxy resin should be formulated with a hardener designed for temperature resistance, for example, an aromatic amine such as metaphenylene diamine. If possible, the oil content of the washer should be reduced by washing with a solvent such as trichloroethylene, before bonding it to the graphite. *Q-154*

Readers who would like to contribute their own experience with problems similar to those discussed in Dr. Skeist's column are invited to write to ADHESIVES AGE, *101 West 31st Street, New York 1, New York. Please refer to the code number given at the end of each question and answer group.*

CONSULTANT'S CORNER

Wood to Cotton

Question: A dental swab to be made by our laboratory consists of a wooden dowel on a stick 4½" long and an eighth of an inch wide. One end of the wooden stick will have a ball of cotton and gauze that must be glued on tightly so that it will not come apart when in use. Bonding the cotton and gauze to the wooden stick will be done by a machine. If you would help me select a non-toxic glue, adhesive or gelatin that can be used in the mouth and that will not come apart in water, I will be very grateful.

Answer: There are many adhesives which will bond wood to cotton, of course. The problem is complicated by the requirements of water resistance and non-toxicity. For water resistance, a solvent adhesive is recommended rather than a latex type, since the latter usually contain watersensitive emulsifiers and stabilizers. Most resins are non-toxic, but other ingredients may be harmful.

A vinyl chloride polymer lacquer is suggested. It should contain no stabilizers, except possibly the harmless but ineffective calcium esters. The plasticizers should be chosen from the small group approved by the Food and Drug Administration, for example, the citrate esters available from Pfizer Co. *Q-155*

Flexible Adhesive for Wood

Question: I have recently been given a project which involves fastening together two wood laminates one inch thick by three inches wide. The method which has been advocated is one of boring a hole through the laminates and filling this hole with some sort of plastic material.

The bonding material used should have a fairly high coefficient of shrinkage. It must also be somewhat flexible so that when the wood laminates swell, this "slug" of material will also expand in response to the pressure exerted by the wood. When the wood shrinks, this material should return to its original position.

Answer: A highly flexible epoxy may be suitable. Such a composition can be formulated from a liquid epoxy resin, an aliphatic amine curing agent, and liquid polysulfide (Thiokol). Several adhesive manufacturers offer materials of this type. *Q-158*

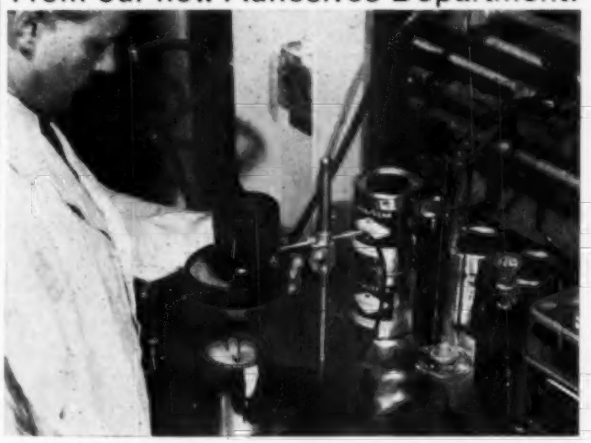
Fabric to Fabric, Leather etc.

Question: We are seeking an all-purpose adhesive that will stick fast on fabric, on shearling, on leather and on pyroxylin sock linings of men's slippers. It is to be used for attaching some specialty labels our shoe firm uses. The material on the front of the label is a phosphorescent pigment covered with a plastic; the backing is a fabric cotton.

Answer: The problem is essentially to bond fabric to a variety of other materials. The phosphorescent pigmented plastic does not concern us, since this surface is not to be bonded.

As a shoe manufacturer, you probably have neoprene rubber cements as well as pyroxylin dopes in your plant. Either of these materials should bond the fabric-backed labels to the adherents you have enumerated. *Q-159*

From our new Adhesives Department:



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PLIOGRIP 12-1. Designed as sealant for aluminum and other metallic joints. Displays high strength, lasting flexibility, excellent weather-resistance.

Perhaps one of these new adhesives—or one still under development—can solve your adhesion problem. Why not see your local Goodyear Adhesives Distributor for more information and samples. Or write Goodyear, Chemical Division, Dept. S-9466, Akron 16, Ohio.

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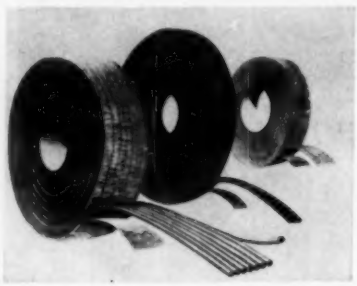


extruded rectangular cross sections are designed for pre-formed areas encountered in channel glazing; the extruded round and rectangular shapes are for use in glazing in combination with rubber sealing compounds. According to the manufacturer, Extru-seal conforms better to uneven joints than many preformed rubber and vinyl neoprene tapes. It won't shoot out of joints when subjected to a "sandwiching" action, and it is easily shaped by hand, adhering to almost any surface with only light pressure. *Pecora, Inc.* **P-329**

Contact Bond Cement

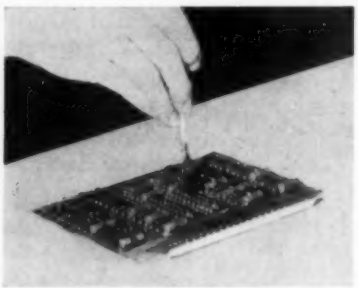
Rez-N-Glue 266 is a fast drying contact bond cement that is especially suited for bonding plywood to linoleum or hard sheet plastic, clad aluminum to plywood, and hard sheet plastic to aluminum. The synthetic rubber-base adhesive forms a high-strength bond immediately after assembly of sections which can then be sawed to shape almost immediately. After 15 minutes, bonded sections will show 90 per cent plywood failure when pried apart. The bond is resistant to water, oils, gasoline, heat and cold. It will remain flexible at temperatures down to —40°F. Adhesive application is by brushing both surfaces to be bonded and allowing them to dry until touch-tackiness disappears. Sections can then be pressed together by a hand roller or hydraulic press. *Schwartz Chemical Co., Inc.* **P-330**

Caulking Compound

Formulated of non-oxidizing, nonmigrating ingredients, DAP Butyl-Flex is a one-part sealant with a butyl rubber base. It is designed to provide a weather-resistant seal between glass, aluminum, steel, marble, plastic and most other construction materials. The compound is odorless and not subject to ozone deterioration. It also offers low heat and electrical conductivity and will not craze or harm plastics. Application is from the cartridge or from bulk containers using pressure equipment or standard hand guns. No mixing or blending is required and no special cleanup or masking is needed before use. Cleanup can be done with a cloth dampened with mineral spirits. *DAP, Inc.* **P-331**

Coating Resin

TC-3047 is a flexible epoxy especially formulated for coating printed circuit boards. It is said to insure the reliability of these boards by



sealing and reinforcing components, preventing insulation failure due to moisture or dust contamination, improving thermal shock resistance, and acting as a vibration damper. Its extremely low exotherm will not damage delicate or heat sensitive components. TC-3047 can be brushed on in varying thicknesses of from 2 to 20 mils in one application. Malfunctioning components can be replaced or repaired easily by softening the coating around the defective area with the tip of a 100-watt soldering iron. The reworked area of board can then be recoated. *Electronic Production & Development, Inc.* **P-332**

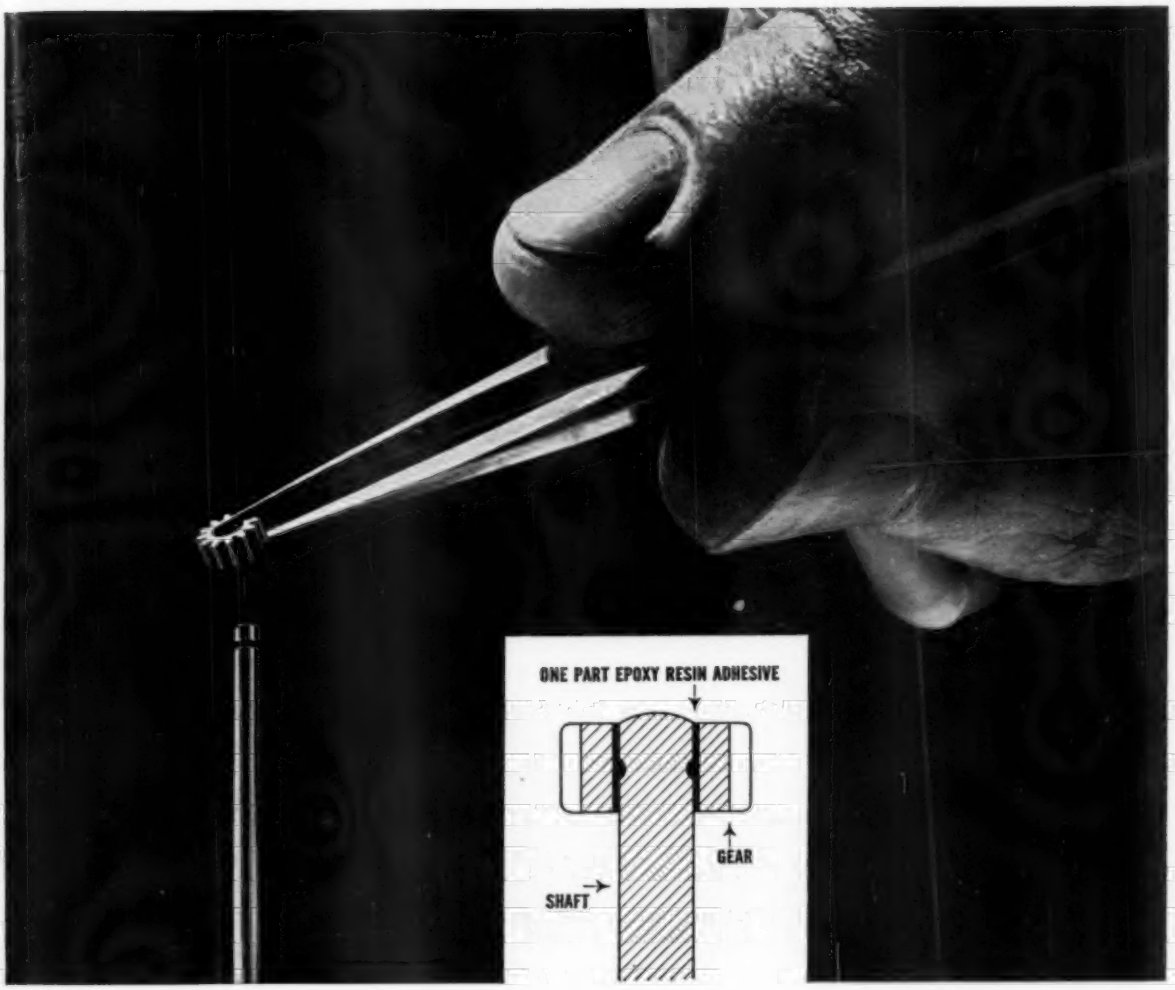
Impregnated Fiberglas

When subjected to heat, pressure, and time cycles, Acto-Glas Mark II, an impregnated woven fiberglas cloth, becomes a fully cured homogenous material in the nature of a laminate. Designed as an insulating material for the electrical industry, the cloth is said to have high physical strength in relation to its weight, excellent dimensional stability and tensile strength, low elongation and good dielectric properties,

and high resistance to solvents and chemicals. It is designed to replace varnish-impregnated cotton tapes. The impregnated cloth is produced with a "B" stage Polyester Resin Mark III or with an epoxy resin. The temperature class of the polyester is 130°C. The epoxy has operating temperature ranges in excess of 150°C. for applications where a complete epoxy insulation system is required. *Sun Chemical Corp.* **P-333**

Two-Part Urethane

Bostik 7070 is said to be especially suitable for use in applications where long contact with oil is encountered. The two-part urethane adhesive is designed to develop strong elastic bonds to leather, natural and synthetic fabrics, cork, wood, nylon, phenolics and many other plastics. Extensive use of the room-temperature curing adhesive is expected for bonding urethane sponge and urethane rubber where resistance to washing and dry cleaning is required. The adhesive is essentially colorless and has no residual odor. The mixed working life of the adhesive is about 18 hours and it can be applied by brush, spatula, doctor knife or roller coater. Under normal room temperatures, assembly of parts can be accomplished 25-60 minutes after adhesive application. The use of heat to speed surface drying can cut this period to five minutes. *B.B. Chemical Co.* **P-334**



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Then SCOTCH-WELD Adhesive EC-1386 was used. The high heat previously required was eliminated. With the end of this trouble source, shaft concentricity and material hardness were left unaffected, the 100% inspection eliminated. Close tolerance requirements between shaft and gear were also eliminated because of void-filling properties of the adhesive. A savings of $56.37 per thousand assemblies resulted.

Company after company is discovering how to save money, speed production and eliminate rejects by using SCOTCH-WELD Structural Adhesives in the fabrication of their products. Perhaps these adhesives are at work right now in operations similar to yours. Find out! For free literature without obligation, write today on your company letterhead to: AC&S Division, 3M Company, Dept. SBY-70, St. Paul 6, Minnesota. "SCOTCH-WELD" is a Reg. T.M. of 3M Co.

ADHESIVES, COATINGS AND SEALERS DIVISION

MINNESOTA MINING AND MANUFACTURING COMPANY

...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

Single Component Epoxy

Unlimited working life for bonding high volume metal and plastic structural assemblies is said to be possible with Scotch-Weld Brand structural adhesive EC-1595, a one-component modified epoxy resin formulation. It provides metal-to-metal shear strength bonds of 2500 psi at 75°F., and maintains high strength at a service temperature range of −67°F to 300°F. The adhesive's self-filleting feature recommends it for honeycomb sandwich construction. Only contact pressure is required during curing operations. The optimum cure is 60 minutes at 300°F., but it can be cured in only two minutes at 500°F. adhesive line temperature. Application is by knife coating, spatula, notched trowel or flowing into place. *Adhesives, Coatings & Sealers Div., Minnesota Mining & Mfg. Co.* **P-335**

Epoxy Coatings

Because they contain no volatile thinners or solvents and give off no explosive vapors, Resiweld 250 coatings are said to be ideal for industrial interiors and closed-in areas where solvent coatings are endangered by sparks or flames. Two coatings in the series, clear (250) and white (251) can be tinted almost any desirable color. An orange shade is available in 259, a corrosion-inhibiting steel and iron primer. Application is by standard spray equipment, airless spray, or by brush, roller, knife or dipping. One coat can be applied in any thickness up to 25 mils or more, but a single coat of 5 to 15 mils is adequate for practically all jobs, states the manufacturer. *H. B. Fuller Co.* **P-336**

Adhesive Pre-Forms

Adhesive films are available with a paper interliner which permits accurate die-cutting or preforming. The 2-mil film has a visible effective adhesive layer that allows the operator to use precisely the right amount of adhesive for each joint. Optimum application conditions as outlined by the manufacturer are as follows: glue line temperature of 325° to 350°F.; pressure of from 100 to 2000 psi; time to effect bond of 10 to 20 minutes. Typical uses of the product include lamination of copper to phenolic board, and lamination of surfaces such as cold rolled steel, brass, galvanized iron, aluminum, phosphor bronze and chrome steel. *Auburn Mfg. Co.* **P-337**

Pipe Joint Compound

Gasoila is a pipe joint and sealing compound that comes in a pint-sized can with a brush permanently fastened to the lid. It is said to be absolutely insoluble in petroleum products, refrigerants, propane, butane and most other commercial solvents. It contains no grit, remains elastic and flexible, and insures a positive joint. It is nevertheless easy to take apart and withstands severe vibration and temperature changes. The compound is adaptable for use on surface coatings and prevents leakage in contact points, seams, etc. It can be used on threaded or flanged joints and on all connections, with or without cork, fiber or metal gaskets. *Federal Process Co.* **P-338**

Epoxy Packettes

Small plastic containers holding a premetered quantity of both epoxy adhesive and catalyst are said to simplify mixing and use of small

quantities of adhesive. Because the throw-away container serves as a mixing unit, clean-up problems are eliminated. To simplify inspection, the two components included in each PA Packette are colored in contrasting shades such as yellow and blue, or yellow and red. A glance shows if the adhesive and catalyst have been properly mixed. PA-708 is a metal-to-metal adhesive; PA-815 is designed for bonding glass or ceramic surfaces; PA-746 is a special formulation for treated Teflon. *Plastic Associates.* **P-339**

Temperature Labels

Adhesive-backed Temp-Plates are a simple method for temperature detection and indication through 1100°F. Increments calibrated to an accuracy of plus or minus one per cent change from pastel to jet black to give a positive, irreversible record of heat exposure. Highly flexible and immune to most ambient conditions, Temp-Plates will adhere until intentionally removed. *Pyrodyne, Inc.* **P-340**

Water-Soluble Polymers

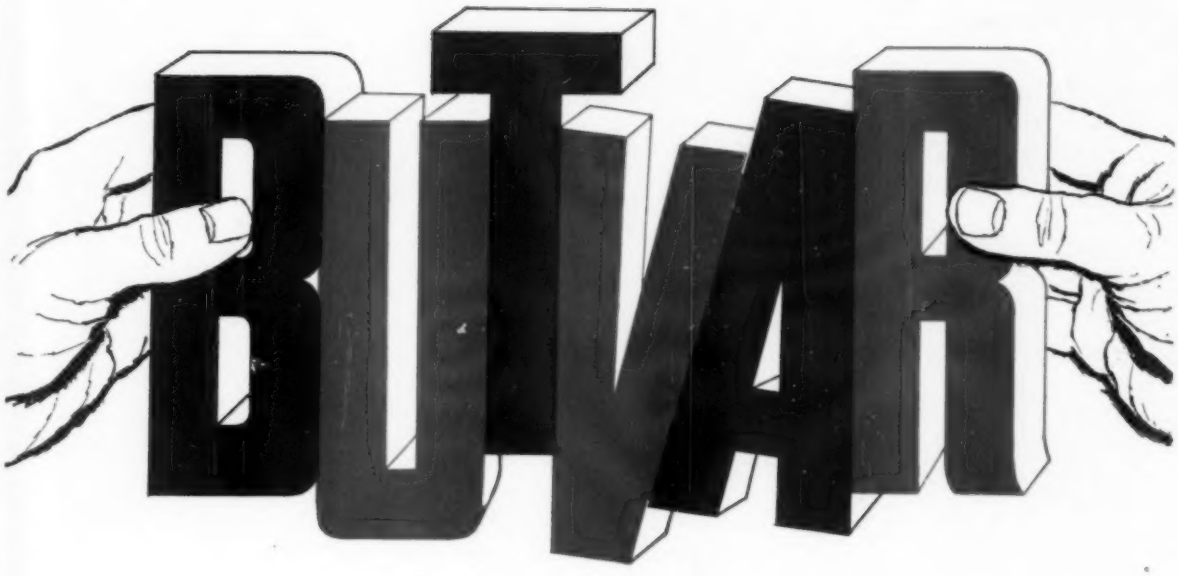
Polymeric carbohydrates etherified to give the water solubility, physical and mechanical properties desired, the family of Ceron polymers now available are useful as adhesives, thickeners, protective colloids and suspending agents. In solution properties, the Ceron polymers have certain characteristics similar to starches; however, they are soluble without cooking and do not retrograde. Even low viscosity solutions can be prepared without color degradation. Ceron N types are nonionic and have wide utility as thickeners, sizings, and emulsion stabilizers. Their adhesive and film-forming properties make them equally useful for tape, label and envelope adhesives. Ceron AN is anionic, providing a net negative charge when in solution. Ceron CN contributes a net positive character to its solutions, since its substituent groups are polar. *Hercules Powder Co.* **P-341**

Polyvinyl Acetate Adhesive

A so-called "white glue" based on polyvinyl acetate resin, 9159 Plyamul is for use in wood assembly gluing and miscellaneous packaging applications. It is supplied at a relatively high application viscosity, which helps produce optimum glue lines and satisfactory bridging on rough surfaces, states the manufacturer. It can be used directly from the container and applied to substrata by spraying, brushing, wiping, rolling or from a flow gun. Features of the adhesive include minimum foaming tendency, good package stability on exposure to temperature extremes, elimination of the darkening caused by iron discoloration experienced with wood high in tannins, and good coalescence at winter temperatures. *Reichhold Chemicals, Inc.* **P-342**

Ceramic Tile Adhesive

Increased open time for bonding ceramic tile is said to be available with Miracle MA-200 Golden Strip Ceramic Tile Adhesive. Tile may be applied to the wet adhesive up to approximately three hours after spreading, depending on temperature and humidity. The adhesive has no solvent odor, is non-flammable and non-freezing. It will bond to any rigid, dry, clean masonry, plaster or wallboard surface. Adhesive smears on tile may be easily removed with a petroleum-solvent dampened cloth. *Miracle Adhesives Corp.* **P-343**



for better adhesion to difficult surfaces

BUTVAR (polyvinyl butyral) resin adds real muscle to adhesive formulations—particularly those to be used for such difficult-to-bond surfaces as metals, plastic films, and other non-porous surfaces.

As a class, BUTVAR resins possess unusual toughness, tensile strength, abrasion resistance and flexibility. In addition, the resins promote exceptionally strong adhesion because they contain three different functional groups in the molecular chain. When combined with thermosetting resins, BUTVAR resins produce structural adhesives having outstanding shear, peel, and creep properties.

The unique combination of physical and chemical properties of BUTVAR resins plus ease of compounding in hot melt and solvent systems make possible a wide variety of adhesives for demanding applications.

A number of BUTVAR resins, varying in molecular weight and chemical composition, are available for your evaluation. Why not test them in your formulations. For complete details, write Shawinigan Resins Corporation, Department 9-J, Springfield 1, Mass. And remember, Shawinigan is your best single source for adhesive raw materials.

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GELVA,® GELVATOL,® BUTVAR® and FORMVAR®
emulsions and resins for adhesives by

SHAWINIGAN RESINS®

capitol cues

THE SPRING PICK-UP IN BUSINESS has brightened prospects for the rest of this year. It has calmed once general fears of an easing in the economy in the second half. Analysts now feel that coming months will bring further gradual rise. They don't expect to see any decline before early next year.

Businessmen waited all Winter to see what April and May would bring. They had sensed that inventory-buying might fall off. And the government had already started to take in more than it spends. They were waiting for the consumer to save the day. But early buying of autos, appliances, etc., was only so-so. Weather was a factor, but was it the only reason for lags?

April and May bore out the hopes of those who were counting on the consumer. His higher buying brought gains elsewhere.
-Retail sales were up a healthy 6% during April and climbed again in May. Better weather spurred autos and appliances.
-Employment expanded by several million in April and in May.
-Unemployment fell sharply, to well below the 4 million mark.
-Industrial output held at a high rate during April and May, despite the big slump in steel production. Gains centered in the soft goods, chemicals, printing, and textiles.

THE OUTLOOK FOR BUSINESS DURING THE REST OF '60 is for continuation of the Spring uptrend. Economists in government and industry are now very confident that activity will keep rising at a steady, gradual clip.

Here are some of the trends the analysts expect:
-Auto sales will continue to increase, helped by special sales by dealers. Production already has begun to move up. Volume this Fall, when new models are introduced, will jump sharply.
-Textiles will see high-level activity as apparel sales hold up.
-Housing will be increasing in coming months. Mortgage credit is becoming easier, and builders will expand their activity.
-Machinery will benefit from industry's plans to increase its plant capacity. Capital spending will go up 15% or so in '60.
Not every line will participate in the upturn. In some, stocks are high and demand is leveling. But easing lines will be few.

STEEL OUTPUT MAY STILL SET A RECORD THIS YEAR, even though activity at mills slumped this Spring. Heavy stocking up by users lifted production in the first quarter to 93.8% of capacity. Spring output, with inventory-buying slowing, averaged about 72%. Third-quarter production will hold to about the same range, but a substantial gain is seen for the fourth quarter.

STILL FURTHER EASING OF MONEY CAN BE EXPECTED during the months ahead. Officials believe that, while the business outlook is good, there is now no reason to fear renewed inflation. They will not have to keep the reins so tight. Indeed, a little ease may insure good times. So the Federal Reserve will act to expand the lending power of banks. As a result, more credit will be available. However, its costs--interest rates--probably won't fall much.

We are suppliers of resins used in various types of adhesives and will gladly refer you to some very fine people who supply adhesives made with our resins.

What can a pinch of permanence do for your adhesive formulation?

We don't know—but we'd like to help you find out.

For many adhesives producers, the pinch of permanence has led to striking advances in adhesives. It has opened the door to new applications, has helped leading formulators develop new markets.

For you, this pinch of permanence—the right phenolic resin—may well be the answer you seek to problems of film strength, tack, resistance to heat or moisture, flexibility or hardness, and many other qualities of the adhesive.

If you haven't looked into phenolics lately, you may be impressed when you do. A lot has happened in the past five years. At Durez, a lot is happening right now. New resins are coming out of the lab every week. One of them may be just what you need.

See an opportunity here? Let us help you take advantage of it. For more information on Durez resins for adhesives, just drop us a note outlining the properties you're after.

DUREZ PLASTICS DIVISION

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HOOKER CHEMICAL CORPORATION

HOOKER CHEMICALS PLASTICS

capitol cues (cont'd)

NONFERROUS METALS WILL HAVE A GOOD YEAR, even though sales won't live up to the bright forecasts made back in January. With the rest of business moving up, the demand for all metals will be strong in the coming months.

Here's a rundown on prospects for the most important metals:
-Aluminum output will exceed 1959's total by 6% to 7%, with actual shipments going up a bit more. Use in auto making will go up 25%. A price increase may be posted this Fall.
-Copper sales will rise some in coming months, but prices are expected to remain stable. Inventories are adequate.
-Lead and zinc will see substantial gains. Zinc volume is likely to gain 8% to 10%, as auto use expands. For lead, the increase will be 4% to 5%. Price increases for zinc are possible, but a world surplus will work against lead.

A RELAXATION OF RULES ON PROGRESS PAYMENTS to defense contractors may now be in the works. Present policy, adopted during the 1957 economy drive, allows a contractor only 80% of costs in advance of completion of the work. The new policy would go back to paying up to a maximum of 100% of the costs. The Defense Department doesn't want to make the shift, but it is under heavy pressure from the Congress and from important military contractors to do so.

Some restrictions in negotiating contracts by the Pentagon also may be coming. Both the General Accounting Office and Congress have been saying more contracts should be let by competitive bidding. The House Armed Services Committee will push a measure for more open bidding in the next Congress.

MANY BILLS IMPORTANT TO BUSINESS WILL BE LEFT OVER at the end of this session of Congress. As a result, they will die, and all of the legislation that fails to become law will have to start through the mill again after the new Congress meets next January. Here are some of the bills left hanging.

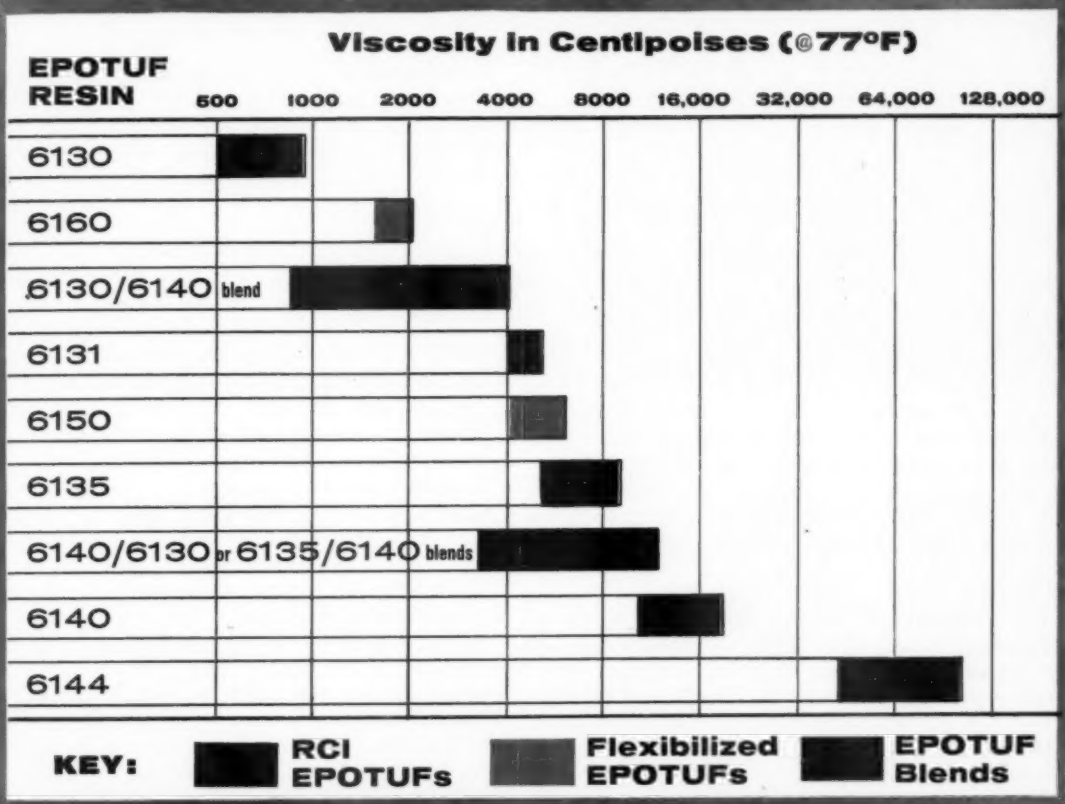
-Farm supports: A bill may be passed in '60, after elections.
-Antitrust: The anti-merger laws may be tightened in 1961.
-Transportation: Reduced regulation may be voted in 1961.
-Natural gas: Less regulation may be blocked again next year.
-Bond rates: Higher rates won't be approved next year, either.
-Depressed areas: The Democrats will try again to help in '61.

HOW WILL THE NEXT PRESIDENT STAND ON BUSINESS ISSUES? Richard Nixon's policies won't be the same as Senator Kennedy's or Symington's, or Johnson's. But it's going to make a big difference which one gets to the White House--in your taxes, in the regulation of your industry, and in the general climate.

Here, from past speeches and Senate votes, are their positions:
-Nixon: His policies would differ from Eisenhower's in many ways. But, he's still a conservative, close to the GOP view.
-Kennedy: He may be the most liberal of leading Democrats. He would probably give the U.S. another Fair Deal Administration.
-Johnson: He's in the center of the spectrum. But, on many of the issues he would act like a down-the-line New Deal liberal.
-Symington: He's somewhere between Kennedy and Johnson. On most questions, though, you can count on him to think like Truman.

RCI Epotuf Epoxy Resins Meet Every Viscosity Need

CHOOSE THE RIGHT EPOTUF RESIN FOR YOUR NEEDS FROM THIS VISCOSITY SELECTOR CHART:



RCI Epotuf epoxy resins offer all these advantages:

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- System standardization is possible
- Production-line time is saved

A unique production process yields RCI EPOTUF epoxy resins that are extremely clear, light in color and highly purified. Hydrolyzable chlorine is at a minimum; and resins for the electrical industry can be guaranteed to contain well below the amount found in the standard specifications of the trade. Because of exceptional quality control, RCI epoxy resins have superior consistency properties from batch to batch. Write today for complete technical information on RCI EPOTUF resins.

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REICHHOLD CHEMICALS, INC., RCI BUILDING, WHITE PLAINS, N. Y.

on the continent

by Felix F. Fluss

• **Why Moscow Tries to Buy Foreign Know-How.** Last year the entire Soviet chemical industry, many governmental agencies, and approximately one thousand delegates held a conference entitled "The Plastic Industry" in Moscow. The East-German publication *Plaste Und Kautschuk* covered this conference, and it is interesting to note that in spite of Communist censorship, several complaints were voiced.

A number of delegates criticized the Department of Plastic and Synthetic Resins of the Government Committee for Chemistry and other government organizations for not synchronizing and co-ordinating all the components of the vast organization. Research and development projects and the introduction of new production methods have been delayed. Particularly annoying has been the inability of the machinery construction industry to fill the requirements of the plastics industry. New equipment and machines are completely lacking.

Furthermore, the construction of new factories and the increase of the capacity of existing factories in several locations (Kemerov, Leningrad, and Armenia, for example) has progressed at a snail's pace. The conference concluded by adopting concrete measures for the development of the plastic industry over the next five years.

As these complaints have been printed in an official publication of the East German Government, one can imagine how grave the complaints must really be, and how dissatisfied the members of the chemical industry must be with all the defects and shortcomings. No wonder Soviet Russia is trying so hard to obtain technical assistance from capitalistic countries. Yet, the question arises: Is it wise to give in and to be hit a short time later by competition which no capitalistic country can meet?

• **New Roadmarkers in Frankfurt.** The city of Frankfurt uses roadmarkings which have to be repainted every six months by hand, a slow and expensive procedure. Recently a French company developed white plastic strips which are glued to the road surface with a special adhesive containing components of latex and synthetic resins.

The adhesive is strong enough to withstand the wear and tear of heavy traffic; the plastic strips have a rough surface and last for a long time. At present the city of Frankfurt is experimenting with these road strips, and if the tests are successful, the entire city area will be equipped with the new roadmarkers. Although the initial expense is high, the investment will pay off within a few years as no renewals are necessary.

• **Adhesives for Concrete, Stone and Steel.** A Dutch factory is manufacturing an adhesive with polymer synthetic resins with extraordinary qualities. The adhesive can be used for bonding construction elements like concrete or natural stone; it is also suitable for the anchoring of steel bolts in concrete or stone. It is supplied in two parts to be mixed in a 1:1 ratio. The mixture is then applied with a spatula to the surfaces of the parts to be joined. Curing time depends on the outside temperature. It takes about 40 minutes at a temperature of 68°F.; an hour and a half at 41°F. Tests have shown that the joined parts are sometimes stronger than the original material. The adhesive is highly resistant to vibration. It is waterproof and does not conduct electricity.

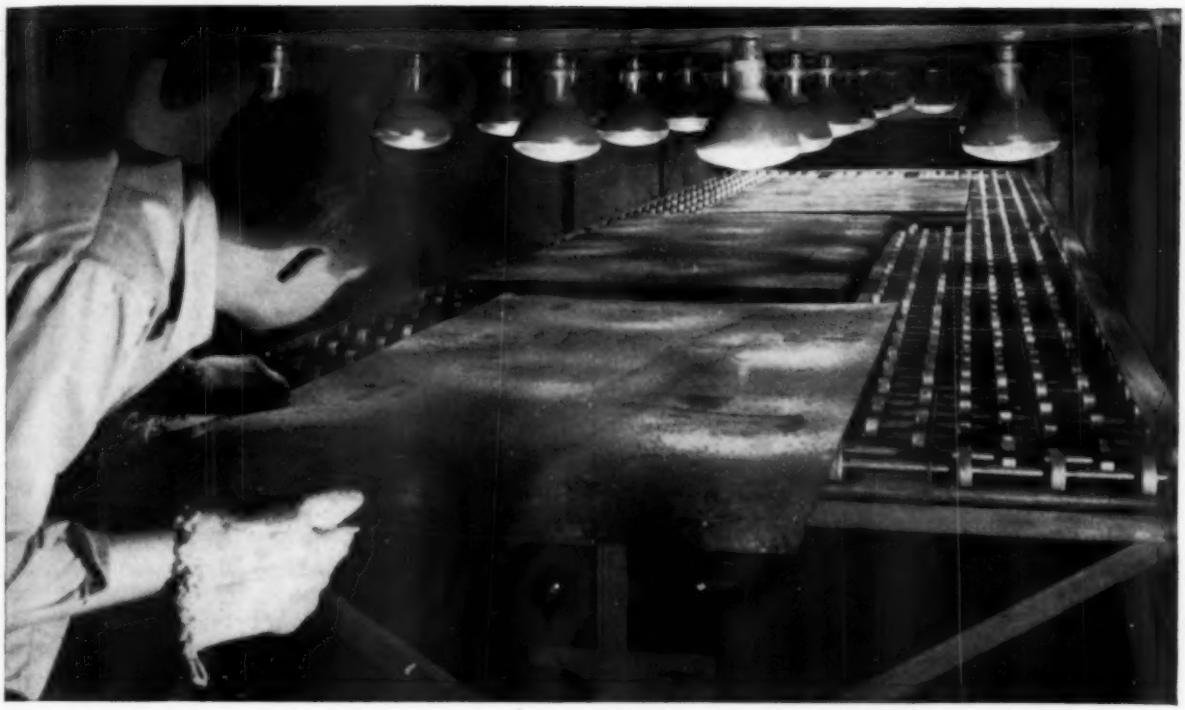
• **Butyl Latex in France.** A new French process has made it possible to obtain aqueous emulsions of butyl rubber. At present only a limited quantity of the product is available for test purposes. However, the manufacturer, Saint Gobain Company, expects to start production before long.

The new emulsion is a concentrate containing approximately 50 per cent dry substance made up of extraordinarily fine particles, and is physically and mechanically stable even when more highly diluted. It is non-toxic and has a viscosity which adapts itself to the requirements of processing. It can be mixed with certain minerals, organic solvents, natural and synthetic resins, and cold or warm vulcanization agents can be incorporated.

• **Language Trouble at International Meetings.** As a result of the growing ease of air travel, many meetings take place each month in different parts of the world. Unfortunately, the human mind has not kept step with the progress in jet travel, and it is for this reason that more and more complaints are heard regarding difficulties in human communication.

Participants in international meetings have experienced the agony of listening to, but not understanding, what has been said. A lack of understanding of the one or two foreign languages spoken at such meetings constitutes a great handicap, in spite of translation services.

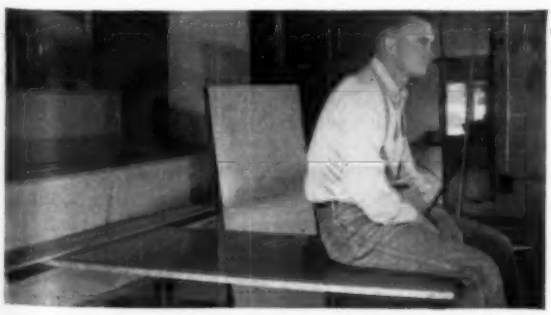
Recently, the director of the Moscow Plastics Institute addressed a meeting of the London Section of the British Plastics Institute. The slight difficulty over language that arose at the London Section meeting is a problem that must be overcome. Apart from



Foamed glass cores, sprayed with neoprene-based adhesive, pass through 275° F. infrared drying oven in first stage of processing cycle. In foreground, porcelainized steel face panel, also sprayed with adhesive, starts through oven.

NEOPRENE ADHESIVE SPEEDS FABRICATION OF SANDWICH PANELS

Ease of application . . . rapid drying . . . and a tough resilient bond are all reasons why Aldrich and Hubbard, Inc., Flint, Michigan, specify a neoprene-based adhesive. Porcelainized and galvanized steel "skins" are bonded to foamed glass and other core materials in the fabrication of panels for curtain wall construction and decorative panels. The result: a strong, lightweight panel.



Strong bonding characteristics of the neoprene adhesive add to the strength of the completed panels.

The company reports that the use of an adhesive based on Du Pont neoprene permits them to operate on an assembly-line basis. The components are spray coated, passed through an infrared drying oven and then mated in a hydraulic press to form the finished panel. At each step, the neoprene adhesive's easy application, quick drying and superior bonding properties offer important advantages.

Neoprene-based adhesives are available from adhesive manufacturers in both solvent and latex types. They can be compounded for application by brush, spray or roller and to meet a variety of service requirements. If you need a better adhesive, ask your supplier about adhesives based on Du Pont neoprene, or write E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department AA-7, Wilmington 98, Delaware.

DU PONT
REG. U. S. PAT. OFF.

NEOPRENE
FOR ADHESIVES

Better Things for Better Living . . . *through Chemistry*

On the Continent (cont'd)

a common world language some time in the hazy future, the ideal solution would be for everyone to speak at least three languages fluently. This is not an impossible target, nor even a difficult one, and will be made easier as language instruction in schools is extended and improved. The need for immediate personal communication is being realized by industry, and it seems likely that industry will provide the necessary push—as it did for compulsory education nearly 100 years ago.

In order to encourage the study of foreign languages, a contest instituted by members of our industry granting cash awards for the best articles dealing with adhesives written in French, German, or other foreign languages, could be arranged. This would not only be a good publicity campaign, but might also encourage other industries to follow suit. As a result of a galaxy of cash prizes for articles written in foreign languages available to students of those languages, the interest in the study of foreign languages would undoubtedly be greatly stimulated.

• **Interkama 1960 in Duesseldorf.** The International Congress and Exhibition for measuring techniques and automation will take place October 19 to 26 in Duesseldorf. The exhibit area will be twice as large as that of the last Congress in 1957. About 300,000 square feet will be available for the 300 companies exhibiting. About 1,000 exhibitors from Belgium, France, England, Italy, Holland, Austria, Poland, Switzerland, Sweden and the United States will participate.

• **The Badische Anilin- & Soda-Fabrik.** The successor of the defunct I.G. Farben in Ludwigshafen was able to raise its sales by 17.5 per cent to 2,268 million German marks ($540 million). It is interesting to note that 38 per cent of the total sales are exports. The effect of American strikes in the chemical and steel industries has been felt, and numerous orders for naphthalene and benzol could not be filled.

Recently a test pilot plant which will convert crude oil to synthetic raw materials, such as plastics, went on stream at Ludwigshafen. It has a capacity of several thousand tons per month.

• **Farbenfabriken Bayer A.G. Leverkusen.** The company has increased its sales by 22.3 per cent, reaching a total sales figure of 2,459 million D.M. ($585 million). It has exported merchandise valued at more than 1 billion German marks ($238 million), equal to about 43.3 per cent of its total production. This year the trend has continued. Sales have increased and exports have risen from 43.3 to 46.5 per cent. Now almost half of the production of German manufacturers is sold in ever-growing foreign markets.

• **Problems of the East-German Plastic Industry.** The many difficulties which the East German plastic industry has to overcome are described in an editorial published in the East German monthly *Plaste und Kautschuk*. The writer, the managing director of the Plastic Institute, complains of the short supply of polystyrene and polyethylene. He says that the demands for plastic components to replace metal parts cannot be satisfied, and he implores the chemical industry to increase its production of raw materials for plastics.

The director reveals that, to make things even worse, plastics are being exported. He says: "There are agreements running for several years which will not be mentioned here, but, evidently, something is wrong with our foreign commerce when polystyrene is exported only in order to fulfill a plan or a quota. The DIA Chemistry (the organization of the socialized chemical industries) would be willing to stop the exportation of polystyrene, provided the moulding industry could ship enough parts. Because these are handled by the DIA WMW Export Department, they are compelled to export polystyrene proper so they will not show a deficit. This, of course, is wrong and should be corrected immediately. The entire industry would be greatly relieved if the export of raw materials would be stopped.

Another problem is the delivery of moulding and other plastic processing machines. Right now, based upon existing facilities, the industry will neither be able to increase its production nor be able to meet international competition. The tremendous amount of complaints regarding the quality of injection moulding machines is mounting.

Considering the stipulated time for the development of new plastic processing machines, it is absolutely clear that the goal set forth by the plastic processing industry cannot be reached. Moreover, it is not known when, or if, new plastic processing machinery will be developed.

In order to prevent the delivery of defective plastic processing machines, the plastic processing industry and the machine manufacturing office will not release any new machines unless they meet the qualifications set forth in the specifications."

• **Overseas Publicity Efforts Increasing.** Leading adhesives companies have from time to time conducted efficient publicity campaigns in many European trade papers and the daily press. Unfortunately, publicity efforts of smaller companies are non-existent. Yet, the dissemination of information in overseas markets is most important in order to stimulate our exports.

However, a few companies are trying successfully to gain publicity in Europe and we found recently in the *Chemie-Markt* (The Chemical Market), a trade paper published in Duesseldorf, Germany, a paragraph on a product called Acton Fluoroetch produced by the Acton Laboratories in Newark, N.J.

ADHESIVES GUIDE

by JOYCE HURD

• A Practical Handbook

designed to serve as a guide to the types of adhesives available for bonding various materials in various applications. This new British publication covers adhesives used in woodworking, bookbinding, footwear, etc., and offers valuable data on the advantages of adhesive bonding and the classification of adhesives.

Topics Covered

Choice of Adhesives for Various Materials.

Encyclopedia of Basic Adhesive Types.

Classification of Manufacturers (British) by Basic Types of Adhesives Made

Catalog of Adhesive Manufacturers and Their Products

Trade Name Index (British)

Miscellaneous Adhesive Recipes

British Organizations Concerned With Adhesives

Bibliography

With contents including data on something like 400 individual adhesives made by about 100 different manufacturers, this publication will prove to be a valuable edition to your technical library. More than 50 main types of adhesives and their properties are covered!

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New and improved standards for the testing of wood bonds are helping industry to "rediscover" wood as a structural material.

Standards for Better Wood Bonding

Our modern industrial economy is inherently dependent on standards—standards for all materials—yet the extent of standards development and their importance in our daily life are frequently overlooked. As evidence of their growth, one need only observe, as a single example, the current issue of the "ASTM Book of Standards." The new edition, which comprises 14,405 pages and covers a broad range of materials, is issued in ten parts and includes 2,658 standards. Forty-four of these standards are listed directly under "adhesives."

In addition, many standards and standard specifications are issued by other societies and organizations. The achievement in standards is all the more amazing when it is recognized that they are mainly developed by voluntary contributions of time by thousands of technical men in industry, government, and educational institutions.

While national standards are of principal interest, there is an increasing activity in the development of international standards. The International Organization for Standards (ISO) already has many committees functioning. Included are such subjects as plastics, softwood lumber, wood, plywood, particle board, fiber building board, and fire tests of building materials and structures. One phase of such international standards is concerned with the unification of test methods, but another phase relates to specifications for products in international trade that may be of great importance to the countries and industries concerned.

The United States has refrained from active participation in many of the ISO committees and merely retains observer status in them through the American Standards Association. Mr. Roy P. Trowbridge, director of engineering standards for General Motors, in a recent article in *The Magazine of Standards*, dramatically points out that this lack of partipation in international standardization is a threat to American industry. There has been marked activity and substantial progress in some fields, however, such as plastics.

Another area of marked international progress in standardization has been through the Conference on Wood Technology of the Food and Agriculture Organization of the United Nations. As a result of FAO studies and conferences over the past ten years, international standard methods of test have been adopted for veneer, plywood, and other wood-base materials, for fiberboards and particle boards, and for wood itself. Additional methods and procedures are under study.

The adhesives industry, which plays such an important role in our diversified industrial economy, has long provided a vital service to the wood-using industries. Early evidence of this wedding of wood and adhesives was the discovery of the art of veneering in the sculptures of Thebes, which dates back to the time of Thothmes II, in 1500 B.C. Evidence shows that, in this era, thin sheets of veneer, hand hewn from contrasting woods, were spread with glue and assembled. Sand bags provided the bonding pressure. The glue probably consisted of broken-up flakes that were softened by heating, and probably was a primitive kind of what is now known as animal glue. This was a hand-craftsmanship operation, and obviously there were no standards.

Since animal glues have such a long historical background, they were considered early in the development of grades and standards. The oldest system of grades in America, and one of the best known, is that established in about 1844 by Peter Cooper, in which glues were classified in order from the highest to the lowest grades as AA extra, A extra, I extra, No. I, IX moulding, IX, and others. The Peter Cooper system served a purpose, but was not generally accepted as a standard. A major objection was that it depended upon a set of samples, the measurable physical properties of which were not clearly defined.

More recently, the National Association of Glue Manufacturers worked out and adopted more uniform, clearly defined, and accurate testing methods by means of which test results can be duplicated in any suitably equipped laboratory. A system of grades has been established on the basis of tests of the jelly strength and viscosity of the glues.

Perhaps no single area of endeavor has been more responsible for the significant advances in the field of modern wood construction than the developments in glues and gluing techniques. During World War I there were available starch glue, hide glue, fish glue, casein glue,

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and blood glue. Only the latter two were somewhat water resistant.

With the advent of synthetic resins, the horizons for glued constructions were greatly widened. The advent of waterproof adhesives of the melamine-, resorcinol-, and phenol-resin types made possible entirely new concepts of wood construction for use under adverse moisture conditions.

Not only have adhesives broadened the potentials of such common products as plywood and furniture, but a whole new industry—the production of structural glued-laminated products—have been developed. Other new and important applications are in the field of sandwich construction, with its potential of employing a great variety of materials for facings and cores, all of which involve proper bonding.

Now, what are some of the areas, and what are some of the problems involving adhesives in which standards play an important part in the everyday production and application of the host of products in these fields?

Since one of the first considerations in the structural application of materials is that of strength, durability, and the establishment of design criteria, much consideration has been given to standard methods of test. Plywood serves as an interesting example. It consists of an adhesive-bonded, crossbanded assembly made of layers of veneer or of veneer in combination with a lumber core, or plies joined with an adhesive. Generally, the grain of one or more plies is approximately at right angles to the other plies, and almost always an odd number of plies are used.

In three-ply plywood, there is usually a wide difference in strength and stiffness in the directions parallel and perpendicular to the grain of the faces, while in multi-ply plywood the properties may be quite similar in both directions. In all instances, modern adhesives properly applied provide adequate bonding to develop the full strength of the material. Some of these types of adhesives are as durable as the wood under practically any type of service, while others are only suitable for service und less severe conditions.

Evaluating Joints

What methods should be used to evaluate the integrity of glue joints under exterior and similar exposures? What methods should be employed for the variety of mechanical tests that may be required, such as compression, bending, tension, panel shear, plate shear, toughness, and hardness? In static bending, what width of specimen, what span, and what rate of loading should be used?

Detailed procedures for all these tests, developed over a period of years and thoroughly evaluated, are now available in the "ASTM Standard Methods of Testing Veneer, Plywood, and Other Glued Veneer Constructions (ASTM Standard D-805-52)." In addition, procedures for the evaluation of adhesives themselves for plywood-type construction have also been developed and are covered in ASTM Standard D-906-49.

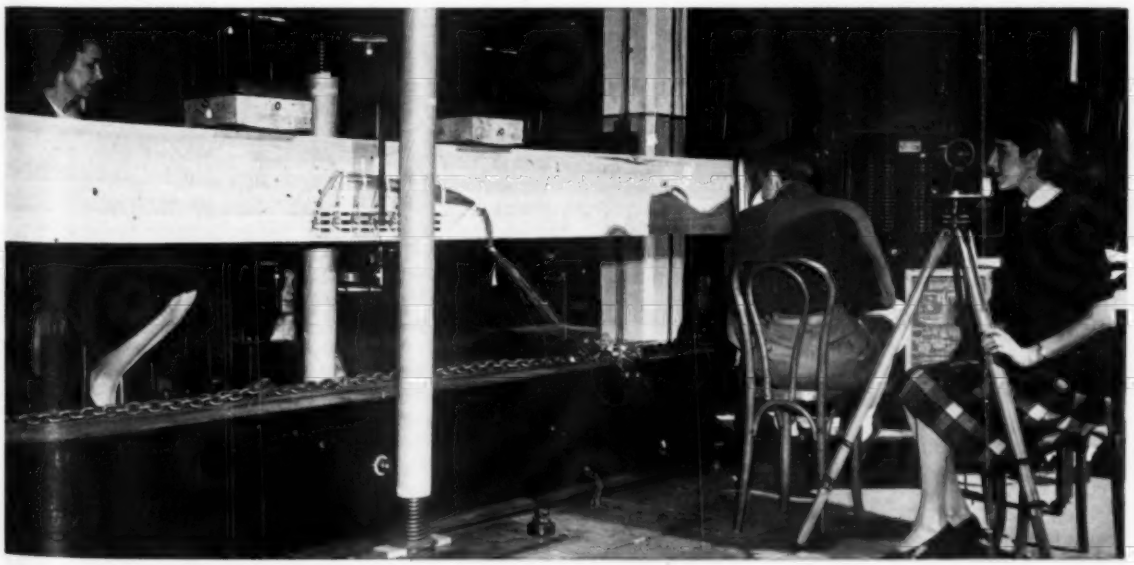
Another phase of testing covers the maintenance of gluing standards in the production of plywood to meet different use requirements. Such standards are vitally important to the consumer as well as the producer.

As an example of consumer interest, consider the family that has decided to join the ever-increasing number of boating enthusiasts, and has purchased one of the popular lapstreak boats made with strip plywood for the hull construction. What assurance is there that the bonding is waterproof?

This assurance comes from continuous quality control tests in the production process, which permits labeling and certification. Certification is possible because the quality control tests have been correlated with long-term weathering and similar exposures.

Plywood glue shear tests are made on notched specimens in accordance with size requirements and procedures established in the standard.

Testing a glued laminated structural beam under third point loading, ASTM D-198-27. Center deflection is measured by the transit and strain at various points on the face is being observed by automatic recorder. (Photo used courtesy of ASA.)



For plywood used in exterior service or for marine construction, both cold-soaked and boiled samples are tested. For the boiling test, the samples are boiled in water for four hours, dried at 145° F. for 20 hours, then boiled again for four hours, cooled, and tested while wet.

This is a practical example of standards in action in the plywood industry. Tens of thousands of plywood glue shear tests are made annually. They are also made to study the behavior of different adhesives under different exposure conditions, such as weathering and alternate wetting and drying.

These control tests illustrate the special series of standards developed under the sponsorship of the Commodity Standards Division, Office of Technical Services, Commerce Department, for establishing and maintaining standards and quality control in industry. Although these are recorded as voluntary standards, they are enforceable through usual legal channels when referenced as part of a sales contract.

The test procedures are covered in Commercial Standard CS 45-55, Douglas Fir Plywood, published by the U. S. Department of Commerce. Hardwood plywood is covered in Commercial Standard CS 35-56.

Also worthy of mention are the many specifications for adhesives and process specifications for the use of adhesives issued by the federal government and the military agencies. While not regarded as standards in the usual sense, these specifications play a very important role in procurement and in government contract work.

About the Author

L. J. MARKWARDT is assistant director of the Forest Products Laboratory. In 1957 he was cited for the superior Service Award of the U.S. Dept. of Agriculture for "capable leadership in executing wood products research programs."

It has been mentioned that the advent of new adhesives has brought about a whole new industry through the development of glued-laminated construction. This consists of forming large structural elements by bonding together laminations of thinner material, with the grain of all laminations essentially parallel. Structural elements can be designed and fabricated to practically any size, in either straight or curved form, to meet particular structural or architectural requirements.

Extensive research has provided the needed design criteria. Standard methods of test, which cover both bending strength and the glue-block shear test to evaluate bonding strength, are employed. Standard specifications cover fabrication techniques in the industry. Glued-laminated wood arches with clear spans of over 250 feet have already been used in buildings.

Use in Ships

Even more spectacular is the use of glued-laminated members in ship construction. An interesting example is in the construction of minesweepers, the nonmagnetic ships that play an important role in our national defense program. In the early days of shipbuilding, the stems, keels, and ribs of wooden vessels were framed of solid, single-piece timbers, or timbers assembled with bolts and other mechanical fasteners. Since procurement of large, solid members has not been practical for some time, glued-laminated construction has not only served as a substitute, but has established new potentials in design.

Here again, standard specifications and methods of test are essential to insure successful service. Even if known waterproof adhesives are used for bonding, what assurance is there that the correct fabrication techniques have been followed properly? How can the end product be properly inspected and appraised?

First, it must be recognized that marine use imposes one of the most severe exposure conditions and requires much more rigid control and different adhesives than fabrication of glued-laminated members for interior use in building construction. Further, if an accelerated aging test is used to evaluate the integrity of the glue bonds, what assurance is there that it will reflect the long-time serviceability required?

Much research has been carried on over many years to obtain answers to these questions. It was first demonstrated that even such refractory, dense woods as oak could be bonded with resorcinol-, melamine-, or phenol-resin adhesives to withstand the most rigorous soaking and drying cycles without delamination of the glue joints, although the wood itself undergoes serious end checking. Results of such accelerated tests were correlated with long-time weathering and exposure. Out of this research was developed a "Standard Method of Test for Integrity of Glue Joints in Laminated Wood Products for Exterior Service."

The original standard adopted in 1953 required a test period of 12 days for the complete cycling. The procedure gave excellent results, but had the obvious disadvantage of requiring too long a time to obtain the results. As a result of research to reduce the time without adversely affecting the evaluation, a revision to an eight-day cycling period was adopted during the past year. There are hopes for a further reduction to three hours, if present potentials develop satisfactorily.

Still other examples of standards in current use are those related to specifications for modified wood. Although wood has elastic properties, it also exhibits plastic characteristics under certain conditions and treatments. While the great variety of species of wood affords a wide choice of material with respect to characteristics and properties, there has been a continuing interest in the possibility of modifying certain properties to provide material with special characteristics.

Such modification of properties may involve taking advantage of the plastic behavior of the material, resin treatment, or both. When pieces of wood within a critical range of moisture content are heated, they can be plasticized and compressed, and when cooled in this condition retain their compressed form. Such densified wood has been given the descriptive name of staypak.

By another procedure, wood can be impregnated with resin-forming materials and then subjected to heat to polymerize the resins. When this is done, the resins formed in the finer structure serve as a roadblock to the entrance of moisture, and greatly increase the stability of the wood with respect to dimensional change under varying moisture conditions. Such impregnation or treatment is usually applied to wood in

How Standards Are Made

At a typical meeting of ASTM's D-14 Committee on Adhesives, members hear R. F. Blomquist, upper left, U.S. Forest Products Laboratory, report on studies of adhesives bond permanance. Upper right, J. E. Rutzler, Jr., Case Institute, Committee chairman; lower left, J. E. Marian, California Forest Products Laboratory, speaks on wood properties. Lower right, Robert Kell, Battelle Memorial Institute, Committee membership secretary.

the form of veneer so that more complete penetration can be obtained. Wood thus treated is called impreg.

If the veneer impregnated with resin-forming materials is subjected to both heat and high pressure, the material can be plasticized and compressed, and a dense, stable material called compreg is produced.

Some special research conducted in cooperation with the automobile industry brought out the potential of impreg made of mahogany and other species for full-scale automobile dies and patterns. Precise measurements are made from these patterns in new-model development. Impreg for this purpose not only can be machined and carved satisfactorily, but it affords three times the dimensional stability of the normal wood. The dimensional stability is particularly important, because these patterns must closely retain their size and shape when held over a period of months or years and under varying moisture and humidity conditions.

As a result of this research, two companies are now producing impreg to meet the demands of the automobile industry. ASTM Tentative Specification D1324-57T for modified wood covers such features as the characteristics of material, resins, treatment, fabrication, and testing procedures for evaluation of the product.

This is but a brief review, with a few examples, of the role standards play in the use of adhesives in the veneer, plywood, and wood-base fields. It should be recognized, of course, that adhesive developments have been expanding rapidly in other areas. These include adhesives for paper, particularly in the multitude of packaging applications and the great potential in paper overlays for wood, plywood, and wood-base materials to mask defects and provide a uniform surface.

A Never-Ending Task

Some types of standards, such as those for machine threads, once agreed on, do not require change. On the other hand, standards that cover specifications for material and methods of test present the continual challenge for modernization, and are consequently subjected to review and revision at frequent intervals. The job of developing and improving standards is hence a never-ending task, and becomes more complex as our economy expands. This is as true of adhesives as of other materials.

Adhesives have been developed to such a point and play such an important role in industry that we think of them as indispensable. In the wood field, the comparatively recent breakthrough of the "moisture barrier" to afford waterproof bonding with synthetic adhesives was a major achievement. But valuable as is this accomplishment, even more is expected from adhesives in this age of space technology. Exotic new metals, ceramics, and entirely new adherends must be bonded.

Can adhesives be developed to break through the "temperature barrier?" Organic metal-bonding adhesives can now be employed for limited service at temperatures in the 500° to 600° F. range. Can we improve them to be of service in supersonic and space vehicles to meet the target of 1000 hours of service at 1000 psi at 1000° F.? Can we develop adhesives for contact bonding that will develop as satisfactory bonds as are at present obtained through pressure contact in curing? Can we develop better methods than present sonic and vibration techniques for more effectively and rapidly evaluating the integrity of large bonded surfaces, as in aircraft?

These are some of the questions and challenges facing the progressive adhesive industry, challenges that will in time lend themselves to further developments and progress in standards specifications and test methods.

Pie in the Sky?

Bonded Airborne Galley Parts

Components of maximum strength and minimum weight for kitchens of airliners are produced by bonding low-density wood fillers such as balsa to die-cut panels of polished aluminum or stainless steel

By ARNOLD PAGE

REF Mfg. Corp.
Mineola, L.I.

Adhesives have helped solve one problem which is a constant challenge to aircraft designers: how to achieve structures of maximum strength and minimum weight. By bonding low-density wood filler to metal skins, REF Mfg. Corp., produces aircraft galley components which are rigid, vibration proof and sturdy—yet light in weight.

At the REF plant in Mineola, L.I., large sandwich structures of stainless steel and aluminum are filled with balsa which is bonded to both metal surfaces. Because all cavities are thus eliminated, these sections are virtually dent-proof and free from annoying squeaks or rattles.

The balsa-filled panels, from one half to one inch thick, form work decks and door panels for the company's Skygalley. These units are designed for in-flight food preparation and service aboard such jetliners as the American Airlines 707, Pan American DC-8, and Eastern Airlines Electra. The galley is custom designed for each different aircraft.

Functional Interiors

In line with the present emphasis on decorator-styled interiors, these highly functional galleys must also blend with cabin design. Surfaces are usually textured or satin smooth stainless steel, and meet the primary requirements of easy cleaning. Corners are rounded for safety, and provided with stainless steel moldings.

Production of the metal-wood sandwich begins with construction of a framework. Sections of U-channels, formed from sheet stainless steel, 0.025 to 0.064 in. thick, depending on size of part being assembled, are spot-welded or riveted into position.

The framework is then hot-soldered to the sheet which will form the outer skin of the door or work deck. This facing surface is formed from 7/16 to 3/8 gage rigidized stainless steel for the doors, or satin-finished stainless for the work decks. A rim, one-half to one inch deep, is formed by brake or die on the outside edges. Access parts and openings are die-cut, to be fitted later with latches, handles, doors and runners. Once assembled, the unit is placed face-down to receive its wood filling.

Balsa wood, cut end-grain for greater strength and dent resistance, is sliced into the proper shapes to fill all spaces around and between framework channels. The balsa squares are routed to fit under the channels which will hold them securely. These sections must be slid into place, and are numbered to facilitate the rapid assembly necessary after the adhesive has been applied. Once the last block has been inserted, it acts as a keystone, locking all of the others into position.

A thin coat of sealer, Minnesota Mining and Manufacturing Company's EC 1022 is applied to the bottom (end grain) surfaces to keep out moisture and act as a base for the adhesive. After curing for at least two hours, at room temperature, wood and metal surfaces to be bonded are thinly coated with 3M's EC 847, applied by either spray gun or brush. In about 15 minutes, some of the solvent has evaporated and the adhesive becomes tacky, at which point the balsa pieces are pressure-fitted in place.

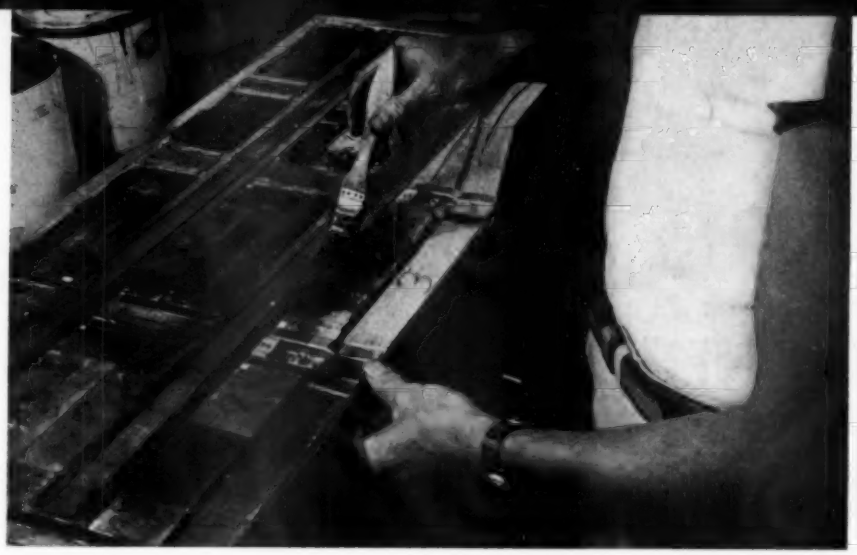
Finally, the top surfaces of the balsa sections are coated with sealer followed by adhesive application to both the wood and the inside surface of the backing plate. In most cases, this plate is aluminum, 0.025 to 0.040 in. thick; occasionally, stainless steel is used.

Clamping Assembly

The back plate is carefully fitted on top of the balsa filler and framework, and the whole assembly clamped. To ensure the strongest possible assembly, surfaces to be bonded are kept in full contact and under pressure. Curing takes 48 hours, at room temperature. Stainless steel trim, riveted along the exposed edges, provides the finishing touch for the completed unit.

As with any components for aircraft, galleys must conform to exacting dimensional and quality specifications. Close to a thousand individual parts go into a single galley, yet the over-all tolerance of the completed unit is no larger than that allowed for a single piece: $\pm 1/32$ inch.

Rigidity is another primary consideration, particularly in assemblies subject to vibration of varying frequencies. By going to balsa-filled doors and decks, we believe that many sources of potential trouble have been avoided, a stronger galley has been achieved, and many annoying vibrations have been stamped out. To a very large extent, adhesives have made this superior construction possible.



● Two hours after application of the sealer coat, the adhesive is brushed onto the treated surfaces. Balsa sections, numbered for ease in assembling, must be slipped under the channel lip. The last piece locks all the others into place.

● After the adhesive has become sufficiently tacky, an aluminum inner panel, containing die-cut openings for doors, latches and handles, is fitted over the balsa-filled framework. Steel trim is riveted to exposed surfaces.

● All-bonded surfaces must be in full contact and under pressure during the 48-hour cure. Because the slightest flaw may mar the part's appearance and cause its rejection, a board is used to protect the metal surface from possible clamp marks.

● Completed Skygalley designed for American Airlines is checked by REF technician. Unit's serving counter and bottom door panel are balsa-filled for high strength and minimum weight. The galley has three storage ovens containing 14 meals each.

The HDLS Paste Process...

and how it was developed

By EDWARD H. HILL
Technical Representative
Corn Products Division
Corn Product Sales Company

Since its introduction a little over two years ago, the new Hot Drop Low Solids process for making corrugated board adhesive has been adopted by more than 30 plants. Among its strong points are faster preparation and easy viscosity control. It produces excellent paste and does not require new equipment if the standard Pratt mixer is being used. It is also economical, since it uses less corn starch.

The HDLS method for preparing corrugated board adhesives is one of the latest in a series of improvements that have helped this industry become one of the country's largest and fastest growing.

A brief glance at the development of corrugated box industry reveals that in the early days, starch and flour were used almost exclusively to make paste. However, because of the slow setting characteristics of this type of paste, machine speeds were slow. In an attempt to find an adhesive that would have all the desirable characteristics and still permit faster machine speeds, sodium silicate was utilized as a major component in paste making. Made by fusing white sand and soda ash, sodium silicate did provide a paste that dried faster and permitted faster machine speeds.

"In Situ" Gelatinization Process

The next milestone in the development of corrugating adhesives came with the origination of the *in situ* gelatinization process. Now widely known and used by corrugated board manufacturers, this process employs starch as its principal ingredient.

Since the advent of this process there have been certain changes in the starches used. Slight modifications have contributed improvements in the process; but, in general, the principle has not changed.

Simply put, this process consists of cooking part of the starch with caustic to make a carrier. When the carrier is mixed with a starch slurry a paste is formed that sets quickly and has many desirable characteristics. With this process, the amount of water used to make a suitable paste was cut from around 15-16 to 3-4 parts by weight, to one of starch.

Attempting to contribute another advancement to the science of adhesives Corn Products Company began experimenting with new methods for developing an improved adhesive that could both be made faster and fit in with the trend to automation. Out of this experimentation the Hot Drop Low Solids process was conceived and perfected. It is so named because (1) its solids content is approximately 16.5 per cent, compared to the conventional average of 22 per cent, and (2) the carrier portion is dropped hot, just as soon

A relatively new method for making starch adhesives used in the corrugated board industry is catching on because it simplifies preparation and provides better viscosity control with standard plant equipment

as it is cooked, directly into the slurry portion. The process has been successful in nearly 90 per cent of its trials. The few failures experienced have been traced to various causes, that do not seem to be related to the process itself.

In the development of the HDLS process there were problems in the selection of the proper starch, working out correct mixing conditions, training of workmen and management, to name only a few.

As mentioned above the HDLS process does not require any new equipment. The standard Henry Pratt mixer, in either the 333-gal. or 666-gal. size, can be used. One change, however, is recommended in the 666-gal. mixer; the regular 5 h.p. motor on the Francis tank should be replaced with one of 7.5 or 10 h.p. rating.

In the development of the process a special laboratory mixer was used. This mixer was designed so that the formulas could be made in grams instead of pounds. It was found that reactions, performance, and characteristics of experimental paste made in this unit were identical to those of paste made in the standard plant equipment.

When work first began on the HDLS process it was found that by using an ethylene oxide treated starch in the carrier portion an improved adhesive could be made by first cooking the modified starch with borax and then adding caustic. However, the cost of starch was higher than normal. In addition, more skill and time were required for preparation.

At this stage of development of the process, only the bottom tank of the conventional Francis-mixer and slurry-tank combination was used. At that time, it was believed necessary to cool the carrier in the bottom tank before adding the bulk of the slurry starch. This meant that sufficient water to cool the carrier had to be added before the slurry starch could be introduced. The slurry starch had to be added very slowly, and so the operation was time consuming. If the slurry were added too fast, lumps, which were practically impossible to break up, would develop. In some cases plant trials were successful with this process, but more often they ended with the operators and management unconvinced of the merits of the process.

Need More Speed

From this experience it was learned that, if the process were to succeed, it would have to be speeded up. Subsequent trials were run using both the top and bottom tanks of the Standard Pratt mixer. The carrier was made in the top tank and dropped into the bottom tank where enough water was added to achieve the desired solids content for the finished paste.

More water was then added to the empty top tank where the bulk of the starch was slurried and then slowly dropped into the bottom tank. This method reduced the time required to make a batch of paste and also cut down on the lumps which had developed when dry starch was added to the cooked carrier.

Though these improvements pleased the plant management, they were unacceptable to the paste maker because all the bags used in the process had to be lifted to the top tank. It made his job more difficult and more complex.

A valuable lesson was learned from this experience and several conclusions were drawn. In order for the process to be successful and completely acceptable to everyone, it had to do four things of equal importance.

(1) Make use of both top and bottom tanks.

(2) Be as easy on all workmen as the process formerly used.

(3) Improve operating conditions.

(4) Improve the quality of manufactured board.

To meet all these demands, the idea of dropping the hot carrier portion of the paste into the bottom tank containing the slurry was conceived and investigated. At that time, many starch men reasoned that the starch would set up in the bottom tank if the carrier were dropped in such a manner. The general feeling was that the tanks would certainly have to be shoveled out after the first full-scale plant trial.

To avoid the development of "fish eyes" in the paste, the conventional procedure of dropping the carrier slowly into the bottom tank was still followed. A good paste resulted and it did not set up. Some difficulty was experienced with viscosity control and to overcome this, dropping the carrier portion fast instead of slowly was tried and proved successful. With the valve in the Francis tank wide open, the time to drop the carrier was cut sharply, of course. This innovation also produced a paste of much more uniform viscosity.

After running the perfected HDLS process successfully in several plants having 333-gal. mixers, tests were begun with the 666-gal. mixers. Doubling the amount of starch, borax, and caustic in the carrier presented problems because the amount of water could not be doubled. The standard Francis tank for the 333-gal. mixer holds 149-gal. and 100-gals. of water were called for; but the 666-gal. mixer has a capacity of only 232-gals. and could accommodate only 150 gals. of water and still leave room for the other ingredients.

Using 150 gals. of water—all that could be added—a trial was attempted, but the motor on the Fran-

Table I—HDLS Formula For Pratt 333-Gal. Mixer

Francis Top Tank	*Single Facer*	*Double Facer*
(1) Add water from top of tank.	13 in.	13 in.
(2) Add 3123 starch. Mix well.	100 lbs.	100 lbs.
(3) Add borax—10 mol. Mix well.	16 lbs.	16 lbs.
(4) Mix and heat to 160°F.	Hold 10 min.	Hold 10 min.
(5) Add caustic (dissolved).	13 lbs.	17 lbs.
(6) Hold after caustic is added.	12 min.	8 min.
Bottom Tank		
(A) Add water from top of tank. Heat to 80°F., if needed.	18 in.	18 in.
(B) Add 3123 starch. Mix well.	400 lbs.	400 lbs.
(C) Drop carrier afst—valve wide open.		
(D) Mix 20 min.—then add 1 pint of formaldehyde before pumping into storage tanks.		

Table II—HDLS Formula For Pratt 666-Gal. Mixer

Francis Top Tank	*Single Facer*	*Double Facer*
(1) Add water from top of tank.	13 in.	13 in.
(2) Add 3123 starch. Mix well.	200 lbs.	200 lbs.
(3) Add borax—10 mol. Mix well.	30 lbs.	30 lbs.
(4) Mix and heat to 160°F.	Hold 10 min.	Hold 10 min.
(5) Add caustic (dissolved).	26 lbs.	34 lbs.
(6) Hold after caustic is added.	12 min.	8 min.
Bottom Tank		
(A) Add water from top of tank. Heat to 80°F., if needed.	22 in.	22 in.
(B) Add 3123 starch. Mix well.	800 lbs.	800 lbs.
(C) Drop carrier fast—valve wide open.		
(D) Mix 20 min.—then add 1 quart of formaldehyde before pumping into storage tanks.		

cis mixer kicked out because of the resistance of the heavy mixture. To get around this trouble, the amount of starch in the top tank was cut back to 165 lbs., from 200 lbs., and the 35 lbs. added to the 800 lbs. called for in the slurry portion. Good board was produced with the resulting adhesive, but desired viscosity could not be held over a long period of time.

In the 333-gal. formula, 100 lbs. of starch was used in the carrier portion and 400 lbs. in the slurry portion. In modifying the 666-gal. formula it was felt that the 165 lbs. of starch gelatinized in the carrier portion was insufficient as a carrier for the slurry's 835 lbs. of starch.

Next, a combination of 100 lbs. of thin boiling and 100 lbs. of special HDLS thick boiling starch were tested in the carrier portion. No trouble was experienced this time with the Francis tank mixer. However, thin boiling starch costs 60¢ per 100 lbs. more than the thick boiling starch, and this formula modification put the process at a disadvantage. Also, the addition of another type of starch was undesirable.

Going back to the original 666 gal. formula which called for 200 lbs. of Corn Products thick boiling starch #3123 in the carrier, a few ounces of sodium perborate were added to thin the mixture slightly. This prevented the motor on the mixer from kicking out and did not appear to affect the paste viscosity in any way.

Using a brand new motor, additional tests were made without the sodium perborate. This time the motor did not kick out and as a result of these tests it was decided that simply increasing the horsepower of the mixer motor to 7.5 or 10 h.p. would completely solve the problem in an inexpensive and positive manner.

Since this last refinement was made in the process there have been no new developments. The process has proved successful in producing the following results:

(1) More uniform viscosity of paste as used on the corrugating machine.

(2) Improved stringiness and tack of paste which allows closer setting of glue rolls.

(3) Faster drying which permits higher machine speeds.

(4) Flatter board with less warping.

(5) Improved operating conditions.

To ascertain these results, tests were conducted during a series of comparative trial runs carried on under identical conditions. Using two batches of paste, one conventional and one HDLS, one machine was set up so that paste feed could be switched from one paste to the other without changing any other factors which might influence paste performance. The results of these tests confirmed the above five points.

A comparison of the conventional method for manufacturing corrugated board adhesive and the HDLS process shows several differences. Listed below are some of the contrasting characteristics of the two processes:

Conventional Process

(1) Carrier portion is cooled before dropping.
(2) Carrier portion is dropped slowly.
(3) Viscosity of paste controlled by amount of starch and chemicals in carrier portion.
(4) Stabilizer is usually used to keep paste from thinning out.
(5) 333 gal. formula requires 600 lbs. starch.
(6) 666 gal. formula requires 1200 lbs. starch.
(7) Mixing time 1¼ hrs.

HDLS Process

(1) Carrier portion is dropped hot (160°F.)
(2) Carrier portion is dropped fast.
(3) Viscosity of paste is controlled by holding time after caustic is added.
(4) Stabilizer not needed to control viscosity.
(5) 333 gal. formula requires 500 lbs. starch.

(6) 666 gal. formula requires 1000 lbs. starch.
(7) Mixing time 45 min. approximately.

Formulas for both the 333 gal. and 666 gal. capacity mixers are given in Tables I and II. The amount of borax and caustic will vary slightly from plant to plant because of local conditions; but after these amounts have been determined by experience, they will remain constant. The formulas set out in the Tables are proportioned to give 28-32 seconds viscosity at the single facer and 40-45 seconds at the double facer.

Altering the viscosity of the finished paste can be accomplished by varying the mixing time in the Francis tank after the caustic has been added. A short holding time will give a higher viscosity paste; a longer holding time will produce lower viscosity paste. Again, it has been found that holding time to produce a desired viscosity will vary slightly from plant to plant.

After several holding times have been tried, it is a simple matter to determine how long a holding time is required to give a specific viscosity. One example that shows the effect of holding time on viscosity is given below.

Holding Time (Minutes)	*Viscosity (Seconds)*
7	80
10	55
20	32

The ability to vary the holding time in the Francis tank, and thereby produce the desired viscosity, adds a certain amount of flexibility that does not exist in the conventional process where the viscosity is controlled by varying the quantities of starch and caustic.

Re-educating Operators

Like any other new development there is a certain amount of re-education of operators involved. Though this is minimal in the case of HDLS, it is vital to good results.

Two things must be watched closely: *temperature* and *holding time* after the caustic has been added. The temperature aspect will almost take care of itself; because starch gelatinizes near 160°F. the sound of the agitator will alert the operator if the temperature goes too high. The addition of caustic usually causes the temperature to rise a few degrees.

The temperature of a finished batch of paste should be approximately 100° to 110°F. since this is the temperature that gives the best performance at the corrugator. If the temperature in the lower tank is not around 80°F., the water should be heated so that the finished temperature of the batch will be near the desired level.

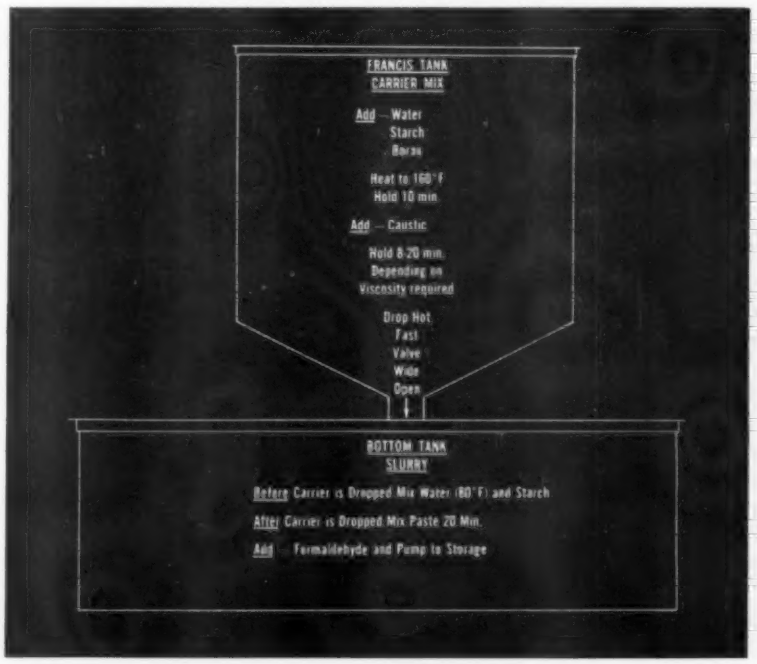
Two theories explain why the HDLS process produces an adequate adhesive using less starch. The first is that the borax and caustic are more efficient because they are both added to the carrier portion and, also, in reversed order. The second theory is that a different adhesive results because a simplified form of starch is produced by the process. Although its success could be due to a combination of these two, the author and originator of this process believes that the latter theory accounts for its performance. It is a challenge to the field of chemistry to determine which theory is the correct one.

As to the future of the HDLS process, it is felt that it will probably be adopted by most plants that use starch in preparing their adhesives. It could be adapted to the techniques of automation. Using the HDLS process, it would be possible to make paste automatically, by pushing a single button that would set off a sequence of processing operations. Automated equipment would in turn add the proper amount of water, starch, and chemicals. Automatic controls would start the heating cycle and even establish the proper time cycle—so that the desired viscosity of the finished adhesives would be attained, again, automatically.

About the Author . . .

EDWARD H. HILL, Corn Products technical representative to the pulp and paper converting industry, has been with the firm since 1946. He was formerly chief chemist of North Carolina Pulp Co. Mr. Hill has a B.S. from William and Mary College.

Schematic of HDLS Process for Starch Adhesive



By R. K. HUMKE
Adhesives, Coatings and Sealers Division
Minnesota Mining and Mfg. Co.
St. Paul, Minn.

Adhesives Today and Tomorrow

A summing up of some of the adhesives industry's accomplishments to date, and a prognosis of what changes new products and techniques can be expected to bring about in the near future

Though not very glamorous-looking materials in themselves, adhesives are an essential part of the design of some exciting end products—as well as some prosaically utilitarian items. The many revolutionary materials and techniques already developed give us confidence that even more difficult problems can be solved for industry.

Let's look at what has already been done.

It is a well publicized fact that our B-58 bombers could not have been built in their weight and design and power without the development of high-performance adhesives. In the manufacture of helicopter rotor blades, complex shapes are laminated from thin sheets of strong lightweight metals to provide durable and aerodynamically smooth surfaces that would not be possible with mechanical bonding methods. Aircraft engineers tell us that adhesive-bonded rotor blades last an average of 1200 hours in service on helicopters, while blades fabricated by other means lasted only 90 hours.

In the construction industry, a company which supplies scaffolding has found that by properly designing the joints of their metal structures to take full advantage of the properties of new high strength adhesives, they can obtain lightweight scaffolding of more uniformly high strength . . . and at a lower cost than was possible with welding techniques. Similar discoveries have been made in the transportation field. For example, by adhesive bonding stiffening members to large flat sheets of thin gauge metal, manufacturers of truck bodies, diesel locomotive cabs and similar vehicles find they can obtain assemblies which are at least as strong as riveted ones. In addition, the adhesive-bonded assemblies are less expensive, neater looking and easier to keep clean than riveted assemblies.

Mitered Corner Joints

Several fabricators of aluminum windows and doors have found that they can use adhesives to form mitered corner joints. The latter are applied to splines or metal inserts and assembled in such fashion that the stresses on the adhesive bond are placed in shear, which takes full advantage of the strength of the product. Some modified two-part epoxy compounds which cure at room temperature and other more flexible higher strength one-part products which are cured for brief periods at high temperatures can be successfully used for this purpose.

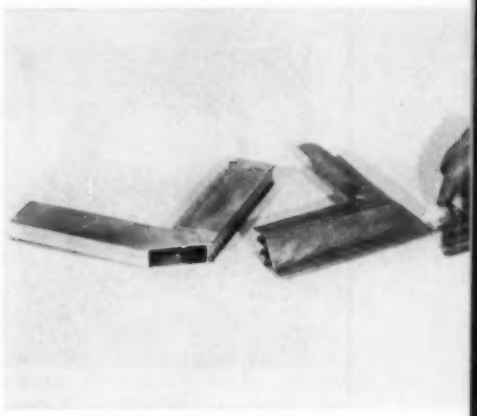
Curtain wall sandwich panels are perhaps one of the best examples in the construction industry of adhesives making possible the fabrication of extremely strong though lightweight structural units. Insulating core materials of relatively low inherent strength can be integrated with various thin facing materials to produce a composite assembly whose combined properties are superior to those of any of the individual components.

The many chemical and physical forms of adhesives, and a variety of application techniques, make them wonderfully versatile construction tools. Let us consider the forms or types of adhesives currently available.

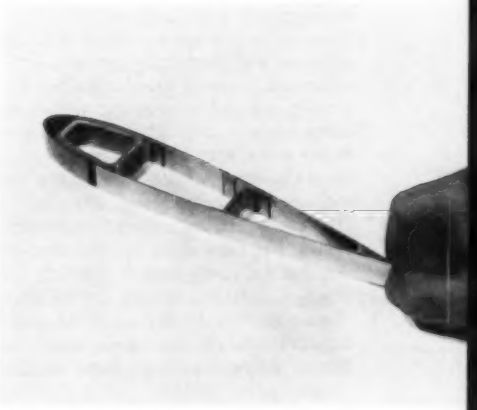
There are liquid adhesive which are 100 per cent solids (as paradoxical as they may sound) and liquid adhesives that set when they are deprived of contact with oxygen. There are adhesives in film form which, upon the application of heat and pressure, transform themselves into powerful bonding agents with thermosetting or thermoplastic properties, depending on their composition. There are double-faced adhesive films which have on one side an adhesive with a great affinity for certain surfaces and on the other side a different type of adhesive with affinity for other surfaces, metal vs. paper honeycomb, for example. There are contact bond adhesives which develop an instantaneous high-strength bond when two coated surfaces are brought together. There are other adhesives that react and set when exposed to light.

Some adhesives are elastic and some are rigid; and there is a selection among all of these for resistance to a whole range of deteriorating influences, such as water, petroleum and ketone solvents, acids and alkalies, sunlight and temperature extremes. Some adhesives swell or ex-

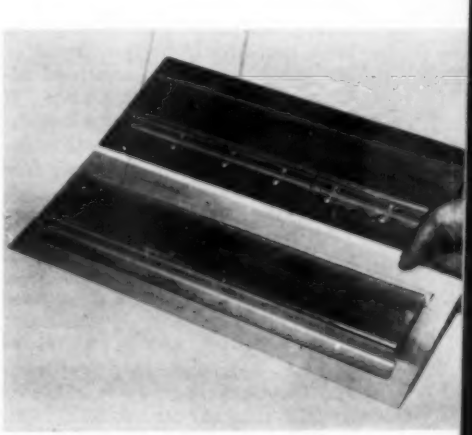
Applying structural film adhesive to wing spar surface of a Convair 880 Jet Airliner. The adhesive both bonds and seals the wing section to form an integral fuel tank unit.



Corner joints of window frames, storm doors and other building products are assembled with adhesives to provide high strength.



Cross-section of a helicopter rotor blade. Use of a film adhesive in assembly increased the life of the blade considerably.



Comparison of adhesive bonded and riveted stiffening members. Bonding is both cheaper and vastly improves the unit's appearance.

pand to fill a void when exposed to heat. Some adhesives are deliberately conductive so that they can be welded through or so that static electricity can be drained off through them. Some adhesives have insulation characteristics that retard or completely block the galvanic action between dissimilar metals or serve as a thermal-break between metals and other surfaces, to retard the passage of heat or cold.

Bonding relatively impervious materials such as metal, glass, ceramics, or plastics to themselves or to each other is made possible through the use of liquid types that are 100 per cent solids, or film adhesives which react in the presence of heat and pressure. These adhesives eliminate the old problem of removing the liquid vehicle through evaporation or absorption.

Application Techniques

There has been a parallel rate of progress in the development of application techniques which make use of the new adhesives types practical. For example, film adhesives can be readily stamped or die cut to a variety of shapes which match the faying surfaces of the objects to be bonded together. In some cases, the films are purposely made tacky to keep them in place until the surfaces are properly aligned for bonding.

Most liquid products can be sprayed, trowelled, brushed or roll-coated into place. Some are extruded from hand or power driven guns that offer a variety of bead shapes and diameters. Pumps and heating devices now available make it possible to move even the heaviest of these products through pipe lines or hoses to the point of application. Proportioning units and guns developed will accurately and continuously mix the components of highly reactive two-part chemical products in exactly the proper ratio.

This versatility of products and methods for applying and effecting cures of these "chemical welding" agents gives us a basis for visualizing some pretty exotic future products which may be made possible through their use:

Aircraft—One of the most advanced industries as far as the use of adhesives is concerned, is that of the air-frame producers and allied groups. Nevertheless, even more challenging jobs remain to be done with adhesives in some of the aircraft, missiles and rockets now being designed. It seems reasonable to suppose that construction techniques pioneered in the development of modern-day aircraft will be translated into use in long range passenger-carrying space ships, manned satellites, and lunar stations—all of which are possibilities within our lifetime. Structural adhesives that will withstand extremes of heat and cold, and that will ensure air-tight joints between metal alloys that are yet to be developed, are a must and will come to be.

About the Author . . .

ROGER K. HUMKE is marketing supervisor of 3-M's Adhesives, Coatings and Sealers Division. His present assignment is the development of new markets for adhesives in the construction industry. From 1942 to 1947, when he joined 3-M, he was a process development engineer for U.S. Rubber Co. Mr. Humke received his B.A. in chemistry from the University of Dubuque and did graduate work in business administration at Wayne State University.

Automobiles—The automotive industry is one of the most logical places to look for future applications of adhesives. Many industry people believe that eventually a substantial part of automobile bodies will be adhered or chemically welded with adhesives, regardless of whether the bodies are of plastic or metal or combinations of these materials. Some experimental work has already been done to substitute adhesives for welding in fabricating automobile frames. A major automotive manufacturer is now utilizing adhesives to bond a stiffening section beneath the hood of his 1960 model. In addition, there are several hundred well-known automobiles on the road today in which adhesives have been experimentally substituted for spot welding.

Ships—If there was ever an object that shouldn't have a hole punched in it . . . it's a boat! It is safe to forecast that screws and bolts and rivets will eventually be replaced with adhesives in the fabrication of boat hulls. Many wooden and plastic boats are already being adhered or laminated together by means of adhesives or high strength sealants. It seems rather logical to form a seamless metal or plastic boat whose exterior surfaces would be entirely free of screw heads or rivet heads which impede its passage through the water. With no seams, there would be no need for caulking.

Appliances—Printed circuitry for electronic equipment is dependent upon adhesives and is bound to progress into fields other than radio and television. Progressive manufacturers are already experimenting with adhesives that will bond cooling coils to metal sheets, and eliminate the tedious process of soldering, brazing, or welding.

Furniture—New opportunities for adhesives are also developing in the furniture industry. Of course, makers of wooden furniture have been major users of glue for years, but countless yards of textiles and plastics are still being nailed to wooden frames. It is possible that this operation can be made more economical and efficient through use of fast-setting adhesives. As more and more furniture for homes and offices is being made of metal and plastics, it would seem reasonable to expect that markets will develop here for structural adhesives.

Apparel—The day is probably not too far off when we will see shoes assembled without sewing or nails. We have already seen advertisements for adhesives intended to mend socks, to repair sewn seams in clothing, to patch and repair fabric and carpets and even to replace thread for the attachment of buttons.

Plumbing—The plumbing industry is a possible future market for some adhesives now on the shelf and others yet to be developed. There is a growing demand for development of plastic piping and some builders are even thinking in terms of threading flexible plastic tubes through a building in the same way that electrical or telephone wiring is threaded today. They would like to see all piping pass through one or more central panels so that if replacement becomes necessary it would simply be a matter of attaching a new plastic pipe section to the old one and pulling it through into position. How would these sections of flexible pipe be joined? We hope it would be done with adhesives.

Houses—Home construction is an area that is wide open for adhesive use. In the opinion of some industry observers, nothing is quite so wasteful as the conventional way houses are put together today. The idea of bulldozing a piece of land into a muddy morass and then depositing about a hundred and twenty thousand components into individual piles in the mud—with the expectation that a crew of men will cut, fit and pound these parts together in the rain or cold or heat—borders on being ridiculous. Yet that is how it is being done.

Progressive builders are now asking that just as many components as possible be prepared or prefabricated under factory conditions so that job site labor can be reduced and modern homes produced at costs more and more American families can afford to pay.

In the drywall industry, there are some near-future possibilities with materials or techniques which depart somewhat from the conventional; for example, in attaching board to studs, it is well within the realm of possibility that compounds will shortly be available which will eliminate any need for nails and provide a quickly assembled, durable bond between wall panels and framing members. Some products already available provide more than adequate strength and durability, but are not considered feasible because of material costs, difficulty of application, or excessively long curing time at ambient temperatures. The ideal product, toward which adhesives compounders are working, is a single-component mastic with good void-filling properties and the ability to cure almost instantaneously on application of some form of energy which can be made readily available on the job site.

Two-Ply Construction

In laminating, casein type glues or joint cements have been used in the conventional type of two-ply construction. More recently contact bond adhesives have been used in installations where nails are eliminated from the finish-ply. Although some drywall contractors appear to have been reasonably successful in the latter type of construction, improvements are desired which would eliminate the present need for coating both surfaces and the difficulty of placing or repositioning of board when improperly aligned on the first attempt.

There are some promising liquid compounds, both one-part and two-part types, which are under evaluation; and it appears that the final

answer may be a compromise between material cost and labor factor, as well as between ease of application and rate of strength development. It goes without saying that use of nail-less face plies will not reach full acceptability without definite improvements in the fiber strength of facings on the gypsum board itself, or a more uniformly higher strength between such facings and the core of the board.

Joint-finishing operations could profit from a non-shrinking compound which could be applied in one operation, would cure rapidly by itself or with applied energy, and could be easily sanded or smoothed to produce the same paintability and light reflective characteristics as adjoining wall surfaces.

Various materials and technologies have been evaluated towards solving this problem, and many have been eliminated from consideration because of too high material cost, difficulty in mixing or application, or inability to sand or otherwise blend into surrounding wall surfaces. Some other promising technologies are under laboratory evaluation.

Both the users and manufacturers of gypsum board panels are well aware of some of the deficiencies in this building material: its relatively fragile skin and brittle cores and the need for improving its acoustical properties. Some architects and builders who wish to design around these deficiencies visualize the ultimate in wall construction as a modular structural sandwich panel, prefabricated from skins of plastic or textured metal bonded to cores of strong, lightweight plastic foam. Without regard for obvious economic factors and the problems of changing established building practices, we can indicate that there are already available chemical compounds capable of making such building panels of the future and that there are adhesive compounds capable of bonding them into complete structures.

To summarize—it is conceivable that almost any bonding requirement can be solved by the research staffs of the adhesives manufacturers, working with the virtually limitless combinations of new organic polymers which are continually being made available.

Acknowledgment

The above article is based on a talk originally presented at the Building Research Institute Conference on "Adhesives in Building."

Zeroing in on a Bonding Problem

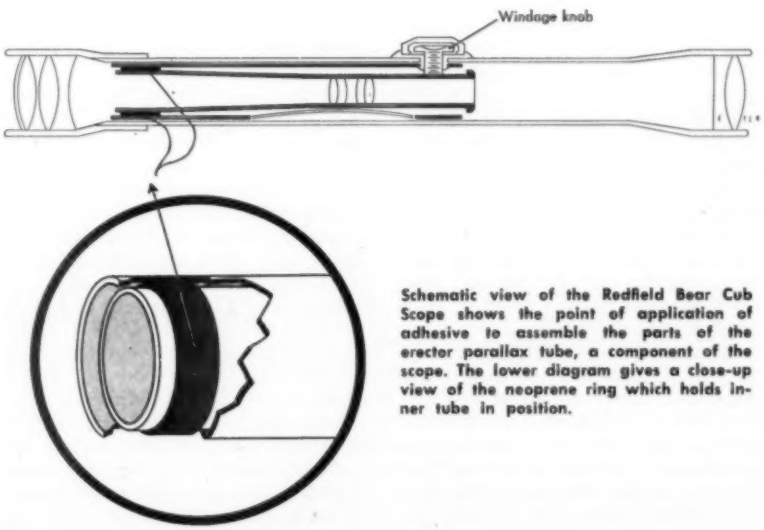
A quick-setting adhesive proved to be the answer to a difficult problem which recently faced engineers at the Ames Rubber Co., Hamburg, N. J. The firm needed a simple and accurate method of assembling an erector parallax tube, a component of the Bear Cub Scope manufactured by Redfield Gun Sight Co., Denver, Colo. When placed in the scope the device reverses the image to an upright position, and provides for windage and elevation correction.

The erector parallax tube consists of two black anodized aluminum tubes, one mounted within the other so that the free end of the inner tube "floats." The mounting is done by bonding a small neoprene ring manufactured by Ames between the two tubes at one end of the component. The ring provides an excellent expansion type joint, holding the inner tube in position, yet allowing the free end to move.

The problem arose in maintaining a $\pm 3/1000$ inch concentricity tolerance specified by Redfield. Initially, attempts were made to assemble the tubes by vulcanizing the rubber ring in place. This system required a complex jig to hold the tubes in place in the curing oven and was costly in both materials and labor. Noncon-centricity of the two tubes frequently occurred caused by the differences in the coefficients of expansion of the aluminum tubes and the steel jig, as well as the difficulty in controlling the flow of hot rubber. A high rate of experimental rejects was the result.

Design engineers at Ames tried several bonding agents and finally settled on Eastman 910 Adhesive, supplied by Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Co. Their decision was based on the ease with which the adhesive could be applied, its quick-setting characteristics, and its ability to create a bond between the two dissimilar materials stronger than the neoprene itself.

The assembly operation is simple, involves the use of only two small metal jigs. One holds the inner tube in place while the adhesive is placed on the outer surface of the inner tube, and the neoprene ring is press-fitted into place. The second jig holds the outer tube in place while the adhesive is placed on the outer surface of the neoprene ring, and the inner tube is press-fitted into place on the mounting end. The entire procedure takes approximately two minutes, and the part is ready to be shipped.



Schematic view of the Redfield Bear Cub Scope shows the point of application of adhesive to assemble the parts of the erector parallax tube, a component of the scope. The lower diagram gives a close-up view of the neoprene ring which holds inner tube in position.

SYSTEMATIC CONTROL OF

Rubber-to-Metal Adhesion

IN THE WIRE AND CABLE INDUSTRY

Preparation of metal surfaces before applying adhesives is as essential to wire processing as to molded goods making

By **RICHARD P. STOUT**
Hughson Chemical Company
Erie, Penna.

This discussion is concerned with basic elements in rubber-to-metal bonding, specifically as they apply to the wire and cable industry. In the mechanical goods industry, dependable rubber-to-metal adhesion is obtained with adhesives. Bonding procedures may differ greatly from those employed in the wire and cable industry, but the same physical, chemical and thermodynamic principles apply to all rubber bonding processes. An understanding of these principles is necessary for proper bonding operation and control.

Factors in Bonding Conductors

A typical problem is posed by insulation compounds bonded to conductors. Examining the various interfaces it is necessary to consider the following six factors: (1) cleanliness and chemical nature of the metal surface; (2) suitability of the adhesive; (3) uniformity and dryness of the adhesive layer; (4) composition and history of the rubber stock; (5) completeness of wetting at the interface between the adhesive and rubber, and (6) adequacy of heat flow to accomplish vulcanization of both rubber and adhesive.

If the enumerated factors can be stabilized, control of the level of adhesion depends on regulating the amount of chemically active adhesive on the clean wire surface. This can be done by varying the degree of dilution of the adhesive. With reference to the factors affecting adhesion, let us first consider the myriad differences possible in composition of rubber stocks. In the continuous vulcanization process, such stocks are generally formulated for very fast curing. However, the cure rate is not necessarily faster than that of mechanical goods stocks which produce rubber-tearing bonds.

While the insulation compounder works within limits imposed by requirements for smooth extrusion and safe factory processing, the mechanical goods compounder, working on small parts, must use fast cures in an attempt to keep press time at a minimum. Both may compound stocks requiring the same absolute cure rate. If both types of stock are cured at the same temperature, the optima and the time-temperature integrals may be quite close.

Many present day adhesives, being highly chemically reactive, are governed by the same time-temperature relationship that applies to the curing systems in the rubber stocks. The adhesives will cure as fast, or faster, than the fastest rubber stock. A high-temperature short cure can be just as effective as a longer cure at a lower temperature, provided that the heat reaches the adhesive interface. Often an undercured condition exists in the rubber near the adhesive layer when CV units are run at top speed. Using a fast curing rubber stock, it is important to guard against scorching from excessive processing or bin aging. If cure has started, the ability of the rubber to bond and chemically wet an adhesive layer will be seriously impaired.

Compounding rubber stocks for good adhesion is considerably simpler when adhesives are being used, compared to brass plate as the bonding medium. Because of their chemical activity, many adhesives are more adaptable to difficult stocks than brass plate, and their performance is more dependable. Some general compounding principles follow, with the reminder that what is good for bonding may not necessarily be good electrically.

It is well known that large amounts of plasticizers can give adhesion difficulty, and that ingredients that will bleed should be minimized. In butadiene-styrene rubber stocks, either highly paraffinic or aromatic oils give more trouble than do oils of medium aromatic content. This is probably the case because the highly paraffinic oils show decreased solubility in the rubber and tend to bleed, while highly aromatic oils exert a solvating effect on the adhesive and, in some instances, even completely dissolve it away. Waxes, polyethylene and some antiozonants frequently behave in the same manner as paraffinic oils.

Where large amounts of oils are necessary, we have shown that it is generally better for adhesive purposes to add oil to normal butadiene-sty-

rene rubber than to reach the same final oil content by adding extra oil to an already oil-extended polymer. In one situation, a stock having a 45 per cent total oil content, based on the rubber hydrocarbon from an oil-extended butadiene-styrene rubber, gave marginal bonding. By switching to a non-oil extended polymer as the starting material, we were able to add 90 per cent of oil before getting into difficulty. We have also found that some help can be obtained by using a small proportion of ester-type plasticizer along with the medium aromatic oil.

If all other elements in the butadiene-styrene rubber stock formulation are equivalent, polymers with low, bound styrene will generally give better results than those with a high proportion of styrene. The presence of at least 20 parts of carbon black, particularly channel black, will enhance the bondability of a stock. Where applicable, the same general principles of compounding stated for butadiene-styrene rubber also hold for natural rubber.

Neoprene, Nitrile and Butyl

In neoprene, bleeding of partly soluble plasticizers may cause trouble. Most ester-type plasticizers give good results but, unfortunately, several which are usually used for low temperature service (methyl acetyl ricinoleate, dibutoxy ethoxy ethyl formal, tributoxy ethyl phosphate, and one or two proprietaries) can be detrimental. Normally, compromise blends with phthalate or other esters can be worked out. Sulfurmodified (Type G, GN, etc.) neoprene gives easier bonding than does the non-sulfur bearing polymer (Type W, WRT, etc.). However, many good bonding, sulfurless Neoprene Type W stocks are in use today.

When compounding nitrile rubbers, the same problem with low-temperature plasticizers occurs. Stocks made from polymers with high acrylonitrile content are usually easier to bond than those with low content, as long as the plasticizer tolerance of the stock is not exceeded.

In butyl compounding, the use of the high, unsaturated polymer gives far better results than the low. This may be due to the chemical nature of the adhesive bond. Similarly, heat treatment during the mixing cycle is undesirable for bonding. The chemical reactivity of the butyl polymer is altered, and the number of active centers available for chemical bonding with the adhesive is reduced. Use of more than .5 per cent of the aromatic nitroso amine, heat-treating agent may lead to difficulties.

As with butadiene-styrene rubber stocks, we have found it desirable to include a small proportion of ester plasticizer, particularly pelargonates. The use of paraffinic or highly aromatic oils is preferred to medium aromatic oils. If the butyl stock is to be resin-cured, stannous chloride activation should be avoided. A polymeric source of halogen such as Hypalon, which releases chloride at a controlled rate, is recommended for good bonding.

The most important of all the factors in variable adhesion for wire and cable operations consists in the preparation, or lack of preparation, of the metal surface before application of the adhesive. In the mechanical molded goods industry, it is axiomatic that very careful surface preparation is one of the most important elements in obtaining high-strength or rubber tearing bonds. The molded goods operators use grit blasting as well as degreasing, either by solvents or aqueous alkaline materials. Many operators use primers on the metal as a safety factor to overcome deficiencies in preparation and to insure the best possible adhesion at the metal-adhesive interface.

Industry Operations

Unfortunately, the mode of operation in the wire and cable industry normally precludes even what the rubber molder would consider a bare minimum of surface preparation. Removal of loose particles, lubricants, rust preventatives and just plain dirt, must be thorough before the adhesive can contact a tight metal surface. The adhesive will usually stick to whatever it contacts, but if the contacted layer has no strength, such as a layer of powder or grease, the break will come within that layer. A faulty tinning job that leaves platelets likely to peel is a frequent offender.

It is common to see stripped down wires with bright particles of metal transferred to the rubber, or a greasy surface remaining on the wire with the adhesive stuck to the rubber. The mechanism of such failure is evident. Roughening of the metal surface is sometimes helpful, except where material is loosened but not removed, and the loose particles form a false bonding surface.

Cleaning the surface with solvent is frequently desirable, particularly if the deposit is oily. Care must be taken to insure that the solvent is

A Discussion of Basic Bonding Procedures

In summary, the author believes that there are many elements common to adhesive bonding in both the mechanical molded goods industry and the wire and cable industry. He has listed some of the major factors in regard to compounding. He does not believe that the rate of cure is a problem, but that heat transfer may be. It is his opinion, however, that cleanliness of the metal surface is of vital importance, and that we need to learn more about the behavior of wet adhesive when it meets hot, moving rubber under high pressure. If other factors can be held constant, adhesion level can be controlled by selection and dilution of the adhesive.

In ADHESIVES AGE (Feb. 1960, pp. 36-39) a new method of adhesion testing was outlined by G. W. Painter of Lord Manufacturing Co., Erie, Penna. Using this test, Mr. Stout found that even an excellent adhesive system can be made to break at the bond. A higher degree of reproducibility can be obtained than with the ordinary peel test, or with any other test that he knows.

clean, for a dirty solvent merely evens out the oily deposit rather than removing it. It is regrettable that solvents will not remove all deposits, but with some knowledge of the type of soiling to aid in solvent selection a real advantage can be gained.

Water-based cleaners have been used, but they involve the difficulty of requiring a rinse and drying period. Flame treatment is very effective on some soils. Unfortunately, on some materials, notably steel, a flame will produce a thin coating of powder, usually metal oxide, which makes a poor base for bonding.

Technique of Applying Adhesive

The technique of applying the adhesive is extremely important. The adjustment of wiping sponges, felts or diaphragms for CV operation is most critical. The sight of excellent adhesion on one side of a wire and no adhesion on the other, can frequently be traced back to a wiper that puts the right amount of adhesive on one side of the wire while it rubs the other side clean.

The viscosity of an adhesive, as controlled by dilution with a solvent, is important, because the more viscous the adhesive, the more accurately it can be controlled by the wipers and the greater tendency it has to stay in place on the wire. A very thin adhesive is more apt to be completely wiped away and, should a heavy coat of it be used, will run and collect in droplets.

Dilution of an adhesive supplies a mechanism for controlling the adhesion level. It is easy to demonstrate with active adhesives that, as the thickness of the adhesive film decreases, the level of strength also decreases. This is in line with the ability of the adhesive to react chemically with the rubber stock. The more reactants present, the greater the strength at the adhesive-rubber interface. The amount of adhesive required to give a rubber tearing bond depends mostly upon the selection of adhesive and the composition of the particular rubber stock.

Certain commercial adhesives of wide versatility and high chemical reactivity perform more consistently when diluted than others. In one situation which we studied, several adhesives all gave rubber tearing bonds at normal concentration and film thickness. All were then tested at greater and greater dilutions on the same rubber stock. One chemically active adhesive gave reproducible and intermediate adhesion values even on greatly diluted samples. Other adhesives became erratic even when only diluted a little, and completely lost ability to bond after moderate dilution. Thus, if other elements in the system can be held constant and a capable adhesive used, intermediate degrees of adhesion can be obtained by diluting the adhesive to an appropriate level.

The question of wet versus dry adhesive entering the extruder is extremely complex. There is no doubt that a dry adhesive will give the best adhesion to metal. Use of wet adhesive permits the sweeping action of moving rubber in the extruder to wipe the adhesive off the wire. It may be absorbed by the rubber. The volatility of entrapped solvent may promote the formation of blisters at the metal-adhesive interface.

Nevertheless, the need for lubrication at the entering tip of the extruder cannot be overlooked, therefore, use of wet adhesive to perform this lubricating function is frequently necessary. In some cases, use of a solvent or a second coat of adhesive as a lubricant over already dried adhesive is beneficial. The best lubricant should be a poor solvent for the adhesive but a good solvent for the stock. In this case, the solvent is absorbed by the rubber and does not migrate through the adhesive to cause softening at the metal interface.

Suppliers' Viewpoint

Speaking as adhesive suppliers, we believe that the question of what happens at the first instant the adhesive-coated wire enters the extruder is worthy of careful study. Residual solvent, melt viscosity, rheological behavior of thin films under pressure and other less obvious factors provide areas for continuing investigation.

The selection of an adhesive for use in a wire and cable operation must be proven ultimately by actual running on a production machine. In situations where a number of adhesives must be screened against different rubber compounds, a peel test which can be performed on press cured slabs may be helpful. The advantage is one of reproducibility, which is an aid in discriminating between systems of nearly equivalent performance. By a peel test it is possible to obtain both a measure of pull value, as well as seeing an example of the type of break to be obtained.

Epoxies in the Laboratory

In the laboratory of a West Coast refinery epoxy cement has replaced litharge and glycerine mix as a means of bonding metal to glass and creating a joint impervious to attack by hot petroleum waxes and solvents.

The application involves laboratory equipment, specifically calibrated glass tubes used for American Society of Testing Materials Method D 156-53 T.

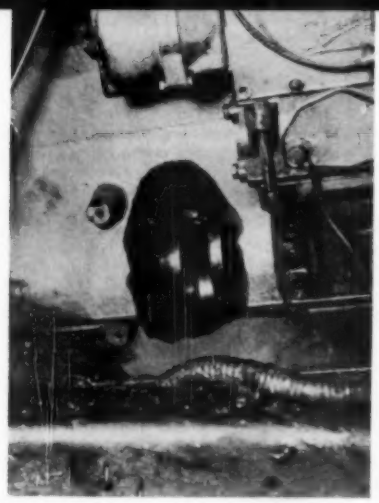
The problem was sealing these graduated tubes into metal fittings in such a way that the joint would be chemical and heat-resistant. The seal created when a tube is cemented to its base and drain-cock must withstand a full range of petroleum waxes whose melting points are anywhere from 128° to 165° F. and above. Normally the temperatures involved run from 160° to 210° F., but temperatures as high as 250° F. do occur.

Previously the refinery had used a litharge and glycerine mix but found that this material did not always provide a satisfactory seal and tended to be messy to use. When Metalset A-4, an epoxy cement made by Smooth-On Mfg. Co., Jersey City, N.J. was used instead, a stronger, leak-resistant bond was created.

The epoxy cement was also found to be easier to use because it requires only simple one-for-one mixing. The only pre-application preparation required for its use was to wipe clean the surface of the areas involved.

The refinery has also used this epoxy cement for other bonding applications where resistance to gasoline vapors and liquid gasoline is imperative. These applications include bonding galvanized metal to galvanized metal, bonding galvanized metal to felt, and, in a small, experimental application involving a cylinder cover, bonding felt to felt.

Damaged Diesel Engine Repaired by Simplified Plastic Metal Surgery



Hole in diesel engine block left the crank shaft exposed. It was repaired in two hours.

Use of a unique form of plastic metal "surgery" saved a South African company more than $700 and several weeks of downtime when the engine block of a diesel truck was smashed through in two places by a broken connecting rod.

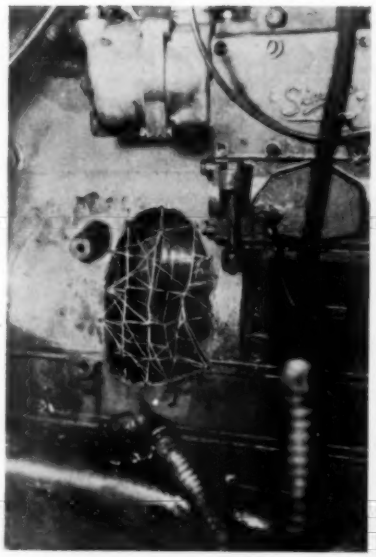
"The holes," reported personnel of Godfrey W. Volkwyn, Ltd., Johannesburg, "were big enough for a fox terrier to jump through." A new engine would cost £450 ($1260) and repairs by the usual method would have run into £200 ($560), to say nothing of the delay for dismantling and reassembling.

It was decided to try an on the spot reparation using a finely powered steel and epoxy resin formulation marketed under the name of Plastic Steel by Devcon Corp., Danvers, Mass. Holes were drilled two inches apart around both damaged areas and wire strung through to form a coarse screen. Pieces of canvas supported inside the block by wood shavings formed a background for the screen.

The soft plastic steel was troweled on over this netting and allowed to harden. Use of the canvas behind the wire prevented the plastic metal compound from collapsing into the crank case before it had cured sufficiently.

When the patches were completely dry, a hardening agent supplied with the formulation caused it to set by chemical action within two hours, it had the strength of the original metal itself. The repaired areas were sanded over and the truck was ready to roll. It has since been on the road for some 14,000 miles.

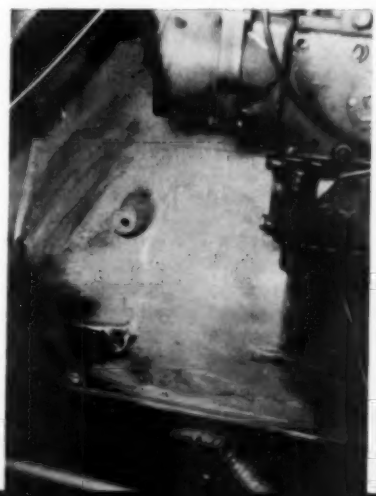
Total cost of the operation: $2.50 for the epoxy formulation and two hours of work.



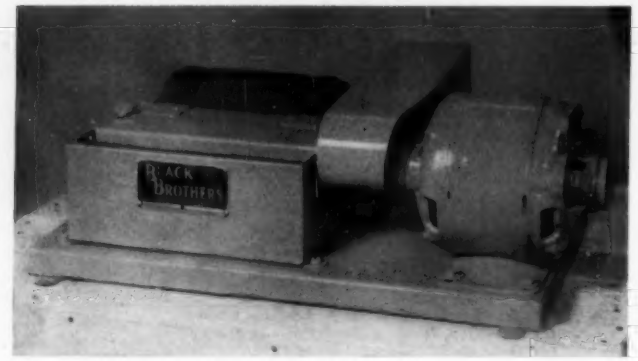
Small holes were drilled around the break and wire used to make a supporting net.

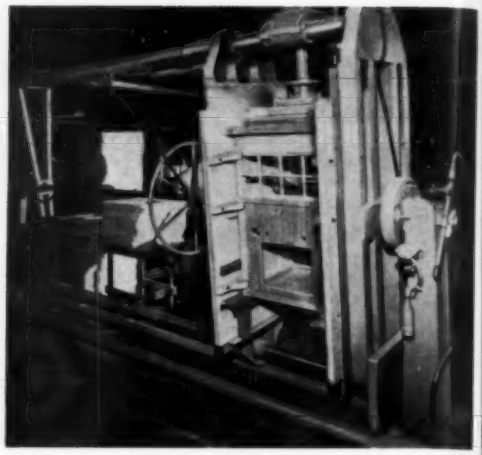
Epoxy-steel formulation is troweled on over wire netting. Note canvas in back of net.

Cured surface was ground smooth with a sander. Truck has run 14,000 miles since.



The small hand-feed glue spreader below is equipped with a grooved application roll. At right, a modern revolving case clamp being used for gluing and squeezing up television cabinets. The radial position of the case is easily changed. (Photos courtesy of Black Brothers Co., Inc.)





Case and Cabinet Gluing

Some tips on the types of joinery, gluing methods and clamps available to suit variations in design

Individual variations in cabinet and case design generally dictate the joinery, assembly and consequent gluing techniques used in production. For example, many case goods designs employ "posts" at the four corners. Here, the joinery must be such as to provide for proper bonding and assembly of these posts to intermediate members.

Often the two ends of a case are first asembled and glued together incorporating two posts and both top and bottom rails. These preliminary assemblies are generally referred to as end panels. The posts and the rails are preliminarily grooved to receive the edges of a panel.

In such cases, though the rails are generally glued to the posts, no adhesive is applied to edges of the panel which fits in the grooves. Bondant applied at these points would complicate assembly and add nothing to construction. In fact, where allowance must be made for a hygroscopic response to variations in humidity, glue should *not* be used on the panel edges which should be free to shrink or expand slightly.

Many designs call for case-goods posts which are dowel-joined to the rails. On large lots of such work, a special type of boring machine is employed. This unit employs pairs of boring bits which approach a workpiece both horizontally and vertically so that two adjacent sides of the case-goods posts are bored at the same handling, and the bores are at a perfect right angle to one another. By this means, one boring operation suffices, where two would otherwise be required. When the dowel method of joinery is used, ends of the rails are bored at the same spacing as the posts on a suitable machine. The dowels are then glued and inserted in ends of the rails with a combination gluing-and dowel-driving machine.

Some manufacturers of case goods, and particularly many who make cabinets or cases in smaller lots, prefer to use mortise-and-tenon construction. In this technique, special mortising machines are employed to tenon the rails. Generally, automatic multiple hollow-chisel mortisers are employed. These units are especially suitable for mortising case-goods posts which incorporate small holes to receive tennons on the ends of so-called drawer dividers.

Extremely narrow mortises are necessary, since the drawer dividers are themselves very narrow. On small lots, it is possible to use a single-chisel mortiser for doing this work, but the multiple hollow-chisel machine is much preferred where production quantities justify its use. In gluing and assembling mortised-and-tenoned end panels, the method is much the same as the one used for dowel joinery.

In some instances, end panels are glued up in clamp carriers, though often special end-panel clamps which hold composite ends being glued and assembled in a horizontal plane are employed. Many of the more modern clamps of this type have their clamping action powered by pneumatic cylinders.

Other sub-assemblies which must be bonded and clamped together, preliminarily, include so-called slide frames, which are often of mortise-and-tenon construction. In high-quality cases and cabinets, dust-

panel frames are often used instead. The essential difference between a slide frame and a dust-panel frame is that in the latter, members for the frame are usually grooved on their inner edges and the openings filled in, at assembly and gluing time, with panels of hardboard or plywood. This prevents any dust sifting down from upper compartments into lower drawers, after the case or cabinet is in use.

After preliminary gluing of subassemblies, the *entire* case or cabinet has adhesive applied to joints yet to be made. It is loosely assembled and then squeezed up in a case clamp. Case clamps are especially designed to hold a loosely-assembled case or cabinet between two perfectly-parallel end plates.

Full case clamps may be of either the screw or air-operated type. Even on the latter, preliminary adjustment of one of the plates, in reference to its distance from the other, is made by screw. Both screw-operated and pneumatic case clamps are available from leading builders, such as Black Brothers Company, in a wide range of sizes to accommodate varying dimensions of cases or cabinets on the production line.

Case clamps may be either stationary or revolving. Earlier case clamps were all of stationary type, and units of this type can still be obtained, in either screw or air-operated models. Similarly, revolving case clamps can be obtained in various types of screw or air-operated models suitable for different production setups.

The advantage of the revolving clamp is its special design which permits the entire clamped-up case to be revolved to any desired radial position during production. A pneumatic brake controls the radial position of the revolving portion of the clamp. Thus, on many subsequent nailing, screwing and gluing operations, the operator can revolve the clamped cabinet to bring various working points into comfortable working positions—instead of doing a large amount of stretching and stooping which is otherwise involved.

Gluing Auxiliaries

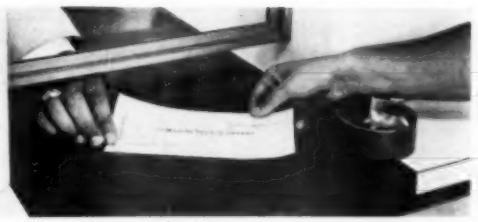
After a case has been glued and preliminarily squeezed up in the case clamp, auxiliaries such as drawer guides, drawer stops, cleats, etc., must still be glued in place. Triangular glue blocks, for example, are applied to internal angles between case members at corners, etc., where they will never be seen in the finished job, but brace the construction.

Much adhesive application incidental to gluing up cases has to do with inserting or spotting bondant in grooves, mortises, dowel holes, corners, etc. For this purpose, some firms provide various types of glue guns are used in conjunction with hoses or lines through which the glue is pumped. This technique provides or faster production than do hand-application devices such as brushes, paddles, etc.

However, it is often found expedient to use a small roll-type spreader for case-assembly applications involving light edge gluing and similar operations. These small spreaders have a roll which may be either hand-turned or motor-driven, and provide an even spread of adhesive. They are valuable from the standpoints of both cleanliness and economy. In the case of motor-driven models, an electric heating element may be applied to such spreaders if desired.

To control the depth of the glue film, the spreading roll employed is equipped with an adjustable scraper. Sometimes, a metal spreading roll is used, but resilient rolls are often fitted instead. While these rolls are primarily intended for use with resinous glues, their resilient surfaces will spread almost any kind of adhesive with greater uniformity. In some instances, small spreaders of this type are provided with special roll groovings, to render them more adaptable for specific types of work.

Organosol Smooths Bank Transactions



A spray coat of vinyl organosol coating is helping to maintain the appearance of metal partitions and counters in the newly constructed Black Rock Office of the Marine Trust Company of Western New York, Buffalo, N.Y.

An estimated 600 people are expected to do business across the bank's counters every day. To protect the metal surfaces from wear and deterioration due to scratching and abrasion, they were given a spray coating of Armorhide—an organosol made from Bakelite Brand Vinyl Resins. In addition, the vinyl compound was also used to coat the partitions between tellers' cages and the administration area. The result is a tough super-surface designed to give added beauty to the bank decor, and provide long-lasting protection designed to bear up under the hardest wear.

Vinyl organosol coatings are now being widely used as finish coatings for countless new products such as computers, accounting machines, tabulators, typewriters, dashboards, television sets and outdoor furniture. Because they have excellent color-retention and oxidation resistance, the coatings allow for pigmentation in brilliant colors.

Spraying is the most widely used method for applying the vinyl protective finishes. A solids content of 60 per cent and higher is common in these applications.

NEWS of the ADHESIVES WORLD

Lerner Addresses GM Adhesives Seminar

On May 4 the Adhesives Committee of the General Motors Corporation sponsored a general conference on adhesives to inform GM engineers, designers, stylists, etc., of the latest developments in the field. Held at the GM Technical Center in Detroit, Mich., the meeting featured several talks, one by M. E. Lerner, editor and publisher of ADHESIVES AGE.

The meeting began with a talk by Ken Downing of the GM manufacturing development staff, who reviewed the types of adhesives currently available and the general characteristics of each. He also outlined the types of applications for which each is best suited. The speaker placed emphasis on those materials which have the greatest potential for GM applications.

Next on the agenda was Mr. Lerner who spoke on "Do's and Don'ts of Adhesives." The speaker outlined current practices for getting the most out of adhesives and listed pit-falls to avoid when selecting and using materials. Among the subjects covered by the speaker were design aspects of the parts to be joined, theory, adhesive requirements, heat limitations, solvents, etc. Emphasis was placed on structural adhesives and the needs of high production manufacturing plants.

Gust Ilkka of the Polymers Departments of the GM Research Laboratories, spoke on tests available for evaluating adhesives. This included a review of procedures recommended by the American Society for Testing Materials from the viewpoint of GM needs. Tests made to better serve GM were described. Comments were made on the correlation of laboratory test results with performance in service.

Most of the afternoon session was devoted to a discussion of divisional and staff experiences with adhesives. It was noted that several organizations have made considerable progress in simplifying the assembly of various products. Different staff members described the materials used, the experiences which led to the selection of these materials, and significant features of production setups. Other staff members described progress which is being made in the consideration of adhesives for joining problems.

Through the use of exhibits, including charts, pictures and samples, several suppliers showed the progress being made in the adhesives field and the potentials which exist for GM. Suppliers furnished these exhibits although their representatives were not in attendance at the meeting. Among the exhibitors were: Cycleweld Products, Minnesota Mining, Rubber & Asbestos, Shell Chemical, Armstrong Cork, and B. F. Goodrich.

The conference was organized by Bruce A. Smith, secretary of rubber and plastics activities of the GM Production Engineering Section. Frank Suzik of the Detroit Transmission Division, served as conference chairman.

"It's for the next guy who says 'it's a sticky business you're in'."

Adhesive Test Group Hears Richards

Alan G. Richards, executive vice-president, Bjorksten Research Laboratories, Madison, Wisc., was the featured speaker at the May 18 meeting of the Testing of Adhesives Committee of the Technical Association of the Pulp and Paper Industry. In his talk, "Non-Destructive Testing of Adhesive Bonds," Mr. Richards presented the possibility of measuring uniformity of adhesion of paper sheets to themselves or other substrates by the use of thermal effects. He pointed out that this type of non-destructive testing could possibly be developed to a point where it could serve as a control apparatus for high speed laminating. This proposed application is an extension of earlier work involving a study of bonds between rubber and metal and between plastic laminated sheets, he remarked.

William Sederlund (National Starch) presented a talk to the committee on "The Origins and Purposes of the Testing of Adhesives Committee." His presentation was a summation of the beginnings of the committee and the current validity of its original objectives.

During the course of the meeting, the committee considered the formation of several sub-committees designed to promote its work in the future. Sub-committees under consideration included: professional contacts; membership; and activities.

Packaging Group Pledge

Packaging Machinery Manufacturers Institute has pledged $10,000 to Michigan State University to purchase research and development equipment for MSU's School of Packaging. The Institute says this contribution is part of its continuing program to support education in packaging from funds provided by income from its shows.

TAPPI Statistics Course

Application forms are available for the Ninth Pulp and Paper Statistics Course, to be held at Brevard College, Brevard, N.C., August 8 to 19. The course is jointly-sponsored by the Technical Section, Canadian Pulp and Paper Association, and the Technical Association of the Pulp and Paper Industry, and will be conducted by the Institute of Statistics, North Carolina State College. The basic section of the course, run concurrently with the advanced section, will cover the elementary concepts of statistics in 18 lectures and 18 laboratory sessions based on practical examples from the pulp and paper industry. The advanced section is designed for those who already have some experience in application of the basic section topics. Laboratory practice and discussion sessions are planned. Students will be given an opportunity to discuss statistical problems of their own with the instructors and the group. Requests for forms of application should be addressed to Dr. R. J. Hader, Institute of Statistics, North Carolina State College, Raleigh, N.C.

Plastics in Building

H. Dorn Stewart, president of the Barrett Division of Allied Chemical Corp., New York, N.Y., told a sales conference on building materials that nearly one-third of materials used for building homes in the coming decade will be found in "test tubes." "Today virtually nothing from the chemical world has found any considerable use in the building materials industry, but tomorrow we will have very efficient building materials that weren't around when this world was put together," he said. He predicted plastic foam insulation that is far more efficient and easier to apply than present insulation, and whole walls in a panel, complete with plastic insulation, wiring, heating panels and interior surfacing. He anticipated wide-spread use of such plastics as polyethylene for cold water piping, nylon for hot water piping; and other plastics for sewer pipes, gutters, flashings and leaders.

SPI Section Officers

Western Section of the Society of the Plastics Industry has elected new officers for 1960-1961. The newly-elected officers are: *Chairman*, James Watt (Monsanto); *Vice-Chairman*, J. A. Carmien (New Plastic); *Secretary*, Frederic M. Rea (Western Plastics); *Treasurer*, Charles Wurdeman (Rozolin).

Ellsworth E. Kimmel

Constantine J. Ballos

Staley Executive Appointments

Two executive appointments were made recently in the expanding market development division of A. E. Staley Mfg. Co., Decatur, Ill. Ellsworth E. Kimmel was named director of the Industrial Market Development Department, and Constantine J. Ballos was appointed head of the Department's paper industry section.

Mr. Kimmel was formerly with the Koppers Co., in Pittsburgh for 11 years, and had been technical administrator of product development in the company's Plastics Division since 1957. He had previously held positions with Interlake Chemical Corp., Battelle Institute, and U.S. Steel.

Mr. Ballos was formerly with the Atlas Powder Co., Wilmington, Del., in industrial technical sales and marketing. With the company for ten years, since 1956 he had been a senior technical field representative for activated carbons, polyols, surface active agents and polyester resins in the paper, textile and other chemical process industries. He is a native of New York City and received his degree in chemistry from Columbia University in 1950.

Addresses Cargo Group

The weight reduction and space-saving qualities of corrugated and solid fibre shipping containers were emphasized at the April meeting of the International Air Cargo Sales Club of Chicago. Julian D'Esposito, manager, merchandising education and structural development, Container Corp. of America, Chicago, Ill., told the club that paperboard shipping containers reduce tare weight and save space without sacrificing essential strength. He added that these containers (1) are adapted to the high speeds of modern production lines, (2) provide inherent strength, boosted by constantly improved structural design, and (3) serve as important merchandising tools at the retail level. Mr. D'Esposito emphasized the protection given products packaged in paperboard containers and pointed out that paperboard containers are uniquely suited for bulk shipments.

HPI Schedules Meeting

The annual fall meeting of the Hardwood Plywood Institute will be held at the Dinkler Plaza Hotel in Atlanta, Ga., from October 5 to 7. The meeting will begin on the afternoon of October 5 with a board of directors meeting, followed by an Early Bird cocktail party. There will be a membership business session and talks by purchasers and specifiers of hardwood plywood on Thursday. Members will be brought up-to-date on the effect of the Institute's 1960 advertising campaign to promote the HPI symbol. A reception and buffet dinner will be held Thursday night. The meeting will close after lunch on October 7. Julius Stern is chairman of the Convention Committee. Working with him on the committee are Phil Adams (U.S. Plywood Corp.), Ed Biedermann (Georgia Plywood Corp.), and Jack Ramsey (Darlington Veneer Co., Inc.).

Adhesives Feature New York Design Show

Adhesives, and their unique applications, were among the over 10,000 products on exhibition at the 5th Annual Design Engineering Show, held on May 23 to 26 at the New York Coliseum in New York City. Over 20,000 engineers and executives from 20 countries attended the show, produced by Clapp & Poliak, New York, N.Y., and sponsored by the Machine Design Division of the American Society of Mechanical Engineers. Running concurrently with the show was the Design Engineering Conference. The conference covered in detail such subjects as: new horizons in engineering design reliability; fabrication; hydraulics; control systems; materials; automation and use of computers in design.

The Design Engineering Show covered all four floors of the Coliseum and technical experts from 430 exhibiting companies gave advice, answered questions, demonstrated new materials and processes, distributed technical data, supplied samples of new products and conducted performance tests. The exhibits were arranged to provide maximum interest and value. The groupings were: mechanical components; electrical and electronic components; power transmission equipment; metals; nonmetallic materials; adhesives and fasteners; finishes and coatings; hydraulic and pneumatic components; and engineering equipment and services.

Cut away section of vaporizer reservoir shows construction by bonding two concentric aluminum stampings on the inside edge. The adhesive used was a Scotch-Weld one-part liquid modified epoxy adhesive manufactured by the Adhesives Coatings and Sealers Division, Minnesota Mining & Manufacturing Co., St. Paul, Minn. This adhesive application is typical of the many adhesive applications featured by adhesives manufacturers at the show.

Adhesives Exhibits

There were a number of exhibits of interest to the adhesives industry. American Sealants Co., Hartford, Conn., featured its Loctite sealant, a liquid lock for metal parts. Samples of Loctite were distributed at the booth. Examples of its line of pressure-sensitive lables and labeling equipment were shown by Avery Label Co., Monrovia, Calif. Highlighting the display was the company's line of new pressure-sensitive metallics which can be used as decorative trim, panels or identification plates on products, displays and packaging.

The Logo Division, Bee Chemical Co., Lansing, Ill., displayed plastic, metal, glass and wood products treated with its protective coatings. Colovin vinyl sheeting was exhibited by Columbus Coated Fabrics Corp., Columbus, Ohio. It was shown that this vinyl sheeting can be laminated to steel, aluminum and other metals. Dobeckmun Co., Cleveland, Ohio, displayed such products as converted films, foils and papers for use by the packaging industry.

Eastman Chemical Products, Inc., Kingsport, Tenn., demonstrated the effectiveness of Eastman 910 adhesive by bonding, on the spot, different materials to each other. Fasson Products, Painesville, Ohio, displayed its line of pressure-sensitive adhesive products. Shown were printed labels made of paper, foils, Mylar, laminates, vinyls, polyesters and acetates. H. B. Fuller Co., St. Paul, Minn., showed a number of products assembled with its Resiweld epoxy line of adhesives. Featured was a picnic cooler which weighed less than a pound but holds 40 pounds of ice. Also on display was a fire door in which the core of honeycomb paper was bonded with Resiweld to outer sheets of steel.

A number of applications of Masland Duran Clad-On was shown by Masland Duraleather Co., Philadelphia, Penna. Clad-On contains a "built-in" adhesive, coated to the back of the vinyl, and protected with a heavy Kraft paper backing. The product was applied to wood, plywood, metal and hardboard. A variety of types of gaskets, cushions and other components in various sizes and shapes in a wide choice of materials, with both dry-back and wet-back adhesives was shown at the exhibit of Mechanical Rubber Products Co., Warwick, N.Y.

The Adhesives, Coatings and Sealers Division, Minnesota Mining & Mfg. Co., St. Paul, Minn., featured a complete line of new high strength structural adhesives. Included in the exhibit was Scotch-Weld Brand thermosetting film, and one-part heat curing, and two-part chemically curing liquid, modified epoxy adhesives. Typical bonded parts were shown. New England Laminates Co., Inc., Stamford, Conn., displayed its Nelco laminated-plastic sheets which offer product designers and circuit engineers an opportunity to select the optimum material for any application. These clad and un-clad laminates are for the electrical and electronic industries and feature base materials for etched, plated and printed circuits.

Joint Pipe Sealers

A completely new kind of pipe dope for pipe joint sealing was featured at the booth of Permacel, New Brunswick, N.J. Called Permacel 412 Ribbon Dope Thread Sealant, it comes in a new roll form in 260- and 520-inch lengths rather than in a liquid or semi-liquid form. Permacel also displayed such products as PSR 2800 triangular guide line tape; silicone rubber tapes for high temperature coiling wrap and insulation; Teflon tapes; epoxy adhesives; waterproof coating; adhesive sealants; and a complete line of pressure-sensitive tapes, industrial adhesives and electrical insulating materials.

A portion of the display of Raybestos-Manhattan, Inc., Bridgeport, Conn., was devoted to its line of Ray-Bond adhesives. Technical literature on several types of Ray-Bond adhesives.

and coatings was distributed. High temperature and flame retardant laminates were featured by Synthane Corp., Oaks, Penna. Shown publicly for the first time were Synthane Grades ARF-HT and G3-HT, new high-temperature thermosetting laminated plastics. A full line of the firm's high-pressure laminated plastics was also on exhibit.

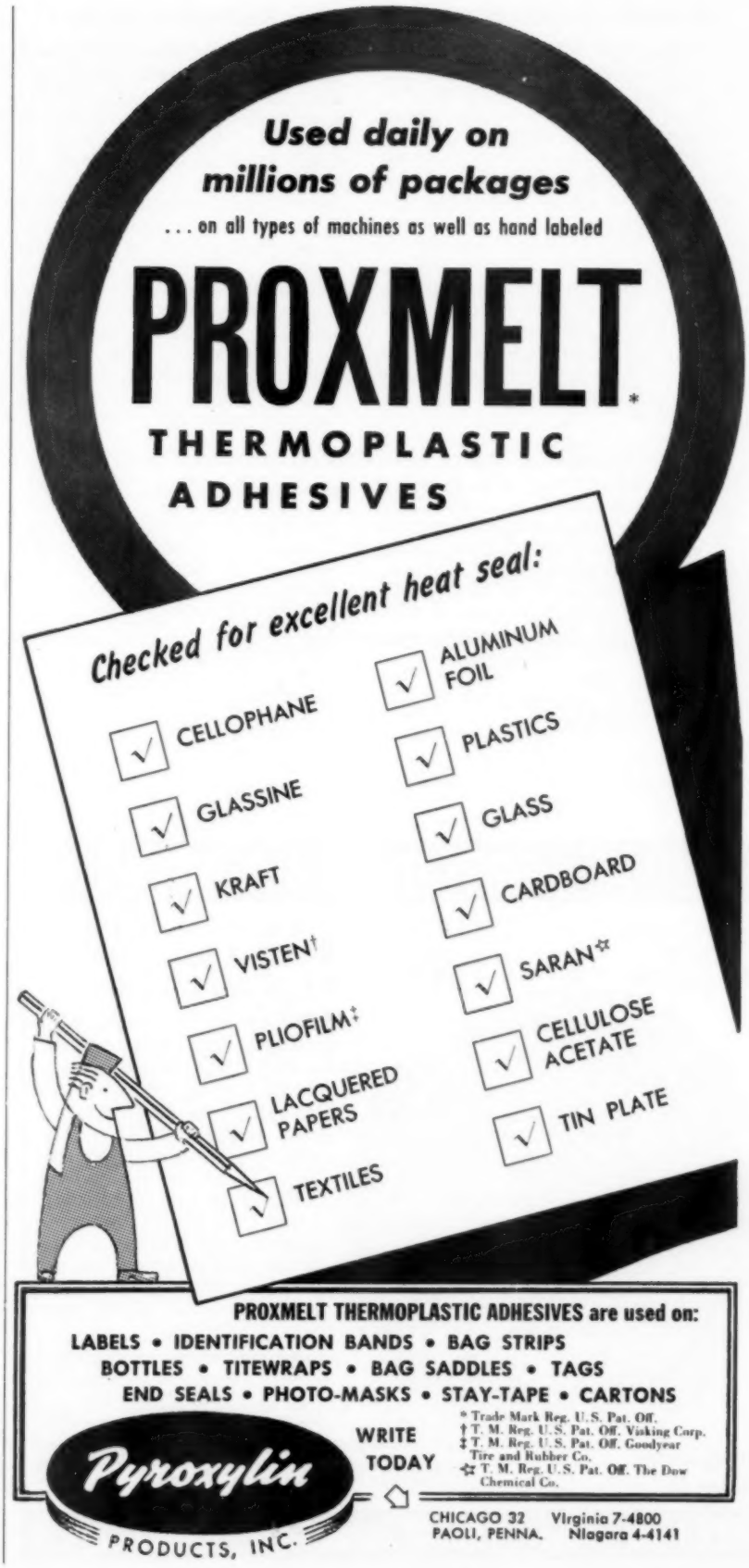
Using products fabricated by its customers as examples, Union Carbide Plastics Co., New York, N.Y., exhibited products based on its newest plastics raw materials for industry. These materials were: a new flexible hardener for epoxies; an extra high impact styrene molding material; an anti-static polyethylene molding compound; a new flame retardant styrene formulation; and a new flame retardant epoxy resin formulation. This display of new materials and processes showed design possibilities in Union Carbide Plastics' five plastics raw materials—epoxy, phenolic, polyethylene, styrene and vinyl.

The display of United Shoe Machinery Corp., Boston, Mass., was devoted to a designers' guide to its products and services. Featured in the firm's chemical systems grouping were its Bostik and Thermogrip adhesives. Bostik adhesives are manufactured by B. B. Chemical Co., Cambridge, Mass., a wholly-owned subsidiary of United Shoe. The booth of United States Plywood Corp., New York, N. Y., highlighted the firm's line of Weldwood products. These included Glasweld; Novoply; Armorply; Industrial Flexwood; Duraply; Permaply; and cut-to-shape plywood.

Clapp & Poliak, the producers of the show, have announced that the 6th Annual Design Engineering Show & Conference will be held on May 22 to 25, 1961, at Cobo Hall in Detroit, Mich.

Food Machinery Expands

Food Machinery and Chemical Corp., New York, N.Y., has expanded its international chemical activities, naming Robert J. Davis to the newly created post of assistant manager for international chemical operations. His duties will include management liaison with FMC foreign subsidiaries and affiliates, and planning responsibility for foreign licensees. Mr. Davis holds a bachelor's degree in chemical engineering from the Massachusetts Institute of Technology and a master's degree from Brooklyn Polytechnical Institute. He was a European representative for Celanese Corp., and joined Food Machinery in 1959.



Paepcke Succumbs at 63

Walter P. Paepcke, chairman of the board and chief executive officer of Container Corp. of America, Chicago, Ill., died April 13 after a brief illness. He was 63. The company, which he founded in 1926, is the largest manufacturer of paperboard packaging. Known throughout the packaging, financial, design and cultural worlds for his innovations and individualistic ideas, Mr. Paepcke also gained fame for rebuilding the mining town of Aspen, Colo., into an international sports center.

He graduated from Yale University in 1917 and joined his father's company, the Chicago Mill and Lumber Co., as assistant treasurer. Four years later he succeeded his father as president. In 1926 he founded Container Corp. of America, and in 1946 he was elected chairman and chief executive officer. Today Container Corp. has 76 domestic facilities in 50 cities in 24 states. Foreign operations include 48 facilities in 28 cities in six countries. Consolidated net sales in 1959 were $322,286,816, and consolidated net earnings were $19,638,780. Mr. Paepcke is survived by his wife and three daughters.

Shim Facilities Bought

The shim facilities of National Seal Division, Federal-Mogul-Bower Bearings, Inc., Redwood City, Calif., have been acquired by the Laminated Shim Co., Inc., Glenbrook, Conn. All of the National Seal shim equipment is being moved to Connecticut, and production of some items will begin almost immediately. There will be no changes in personnel.

Two purposes will be served by the agreement. National Seal will be free to concentrate its efforts on its oil seal and O-ring products, while the acquisitions will help Laminated to round out its expanding line of shims and stampings.

National Names Zonner

William J. Zonner has been appointed district manager of starch sales for the Midwest Division of National Starch and Chemical Corp., New York, N.Y. He will make his headquarters at 3641 South Wastenaw Ave., Chicago, Ill., and be responsible for starch sales in the food, paper, corrugating and paper converting industries.

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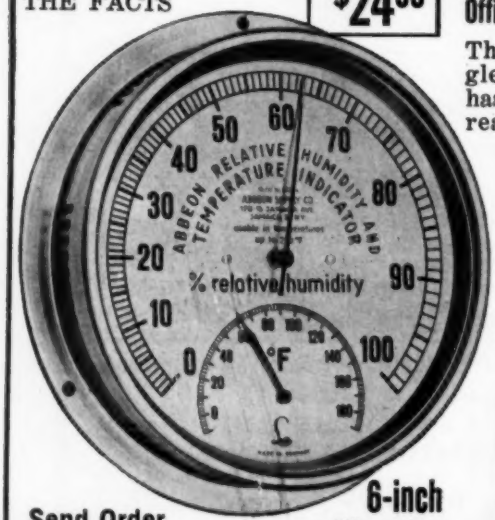

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14th FPRS Meeting

Two secial sessions on "Glues and Gluing" were featured on the technical program of the 14th International Meeting of the Forest Products Research Society held in Montreal, Canada, June 5-9, 1960. Speakers included Philip Northcott, Forest Products Laboratory of Canada, Vancouver, B. C., whose topic was "Estimating Bond Quality in Plywood." R. F. Blomquist and Warren Olson of the U.S. Forest Products Laboratories, Madison, Wisc., spoke on "Contact Cements for Wood Gluing," and Leonard A. Ropella, Roddis Plywood Corp., Marshfield, Wisc., discussed "Types of Suitable Adhesives and Gluing Procedures for Fire-Retardant-Treated Wood." "The Effect of the Wettability of Wood on the Glue Line Behavior of Two Urea Resin Adhesives" was the topic of a paper by H. G. Freeman and F. F. Wangaard, Yale University School of Forestry, New Haven, Conn.

Three talks were given at a special session devoted to industry automation problems as they affect gluing operations. Charles A. Herstrom, Industrial Engineering and Contracting Co., Portland Ore., and Ralph Sullivan, Washington Iron Works, Seattle, Wash., co-authored a paper on "Automating Glue Spreading and Lay-Up." "Automating Possibilities in the Plywood Plant" was the topic of a talk given by Henry M. Preusser, engineering manager of the Adhesives, Resins, and Chemical Division of American Marietta Co., Seattle, Wash. R. K. Stensrud, Technical Division, Reichhold Chemicals, Inc., spoke on "Automating Possibilities with Dry Film Glue Line."

Borden Plans New Units

Borden Chemical Co., New York, N.Y., plans to construct a new product development laboratory and a dry adhesives plant, together with further expansion of existing synthetic resin and formaldehyde production, at its Springfield, Ore., works. The company reports that cost of expansion at the plant will be in excess of one million dollars. Estimated annual capacity of the dry adhesives plant, which is still in the engineering and design stage, will be 10 million pounds. The company states that ground will be broken for the new laboratory this Spring and completion is expected by November of this year. The dry adhesives plant is expected to be on stream by mid-1961. In addition, expansion of existing production facilities is presently underway, the company reports.

Resin Cure Discussed

A cure system for Food Machinery and Chemical's Oxiron epoxy resins was discussed in a paper presented by M. N. Reich at the April 9 meeting of the American Chemical Society in Cleveland, Ohio. The system should be of particular interest for structural laminates and electronic applications, according to the author. "By including a peroxide in the cure recipe containing an unsaturated anhydride and a polyol," he said, "the double bonds of the resin may be copolymerized with those of the anhydride thereby affording a resin with superior heat distortion temperature properties without impairing the other physical properties." The resin, when cured by this peroxide recipe, exhibits a heat distortion temperature greater than 200°C. with a very unusual and flat heat distortion versus temperature curve, he stated. Oxiron resins of 1.4 to 9.6 per cent epoxy content were cured with a polyol, maleic anhydride, and a peroxide to provide superior heat distortion temperatures.

New Celanese Acquisition

Celanese Corporation of America, New York, N.Y., has acquired Plastic Horizons, Inc., a major independent producer of polyethylene film, with plants in Paterson, N.J. and Batavia, Ill. According to officials of Celanese Plastics Co., the acquisition marks another step by the firm to broaden and diversify its plastic product lines. While becoming part of Celanese, the Plastic Horizons organization will remain intact, continuing to function as in the past with respect to personnel and customer relations.

Two Plastic Horizons executives will continue active in the enterprise under its new ownership. William C. Leipold has been appointed manager of polyethylene film production and Maurice Brown has been named manager of polyethylene film sales. Mr. Leipold had been president and Mr. Brown vice-president and secretary, of the Plastic Horizons firm.

National Buys Barge

National Starch and Chemical Corp., New York, N.Y., has purchased the Barge Cement Manufacturing Co., Towaco, N.J., major manufacturer of cements for the shoe repair trade. National Starch will manufacture the present Barge Cement line of cements and thinners, and sales and distribution will continue to be handled by the established Barge distributors.

Joins B. B. Chemical

Franklin N. Ritschel, Jr., formerly with the Electrical Products Division of Minnesota Mining and Manufacturing Co., has joined B. B. Chemical Co., Cambridge, Mass., as a sales engineer for the company's line of Bostik urethane coatings. He will be working on development and sales programs for coatings for wood, concrete and other surfaces. A 1950 graduate of Northeastern University, he holds a degree in chemical engineering.

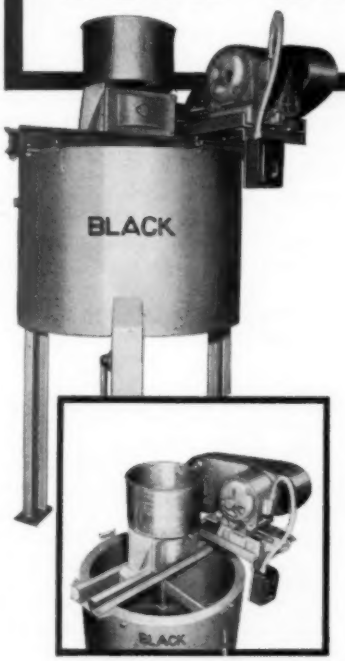
Miracle Licenses Hitemp

Hitemp Wires, Inc., Westbury, L.I., N.Y., will make and sell Zip-on Tubing for wire and cable coverings under an arrangement with Miracle Adhesives Corp., Bellmore, L.I., N.Y., owner of the patent. Lloyd Cutler, president of Miracle stated that Hitemp's entry into this field should substantially increase sales, particularly for high temperature applications. Other licensees are the Zippertubing Co., Los Angeles, Calif., and Alpha Wire Corp.

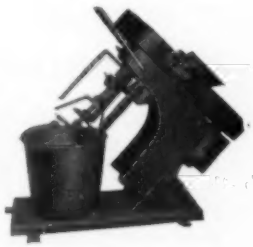
THE BLACK BROTHERS

Cold Glue Mixers

FOR POWDERED OR LIQUID ADHESIVES



The Black Brothers stationary cold glue mixers are made in a full range of capacities from 10 to 500 gallons. They are the result of expert engineering combined with years of practical experience in glue equipment manufacturing. Their many features include: (1) Sifter for glue powder (2) *Double agitators which give a beating action resulting in the smoothest possible mixture in the least possible time* . . . see close-up on left (3) Pressure lubrication (4) Cut steel gears . . . hardened and lapped (5) Large quick-acting valve at bottom. Optional equipment includes (1) water jacket (2) variable speed drive. For full information write today for Bulletin 11-1.



The Black Brothers portable motor driven cold glue mixer is made in 2, 5, 7½, and 15 gallon sizes. It has a number of exclusive Black Brothers features such as glue powder sifter, two-way agitation, and specially shaped flat paddles to give a beating action to the agitator. In addition this mixer has a hinged arm that swings up to allow the pail to be inserted or removed. Write for Supplement to Bulletin 11-2.

"If it Is Gluing Equipment—We Have It"

BB

BLACK BROTHERS, INC.

MENDOTA 25, ILLINOIS

Arabol Expands Capacity

The Arabol Manufacturing Co., New York, N.Y., has announced plans for expanding production facilities which include the opening of new plants in Ohio and Georgia and construction of another unit at a third location. The company is also taking steps to improve the production capabilities of its existing plants.

Construction of a new plant in Marietta, Georgia, has been completed, and the plant will be formally opened in June. The 10,000 square foot facility is planned to permit straight flow processing from raw materials to finished adhesives and is primarily designed to meet the needs of adhesives users in the Southeast. Additional land area has been provided to permit later expansion. Construction of a 20,000 square foot plant in Delaware, Ohio, will commence early this summer, and negotiations are underway for the construction of a third new plant, although the exact location has not yet been decided on.

DuPont Studies Films

The Experimental Station of E. I. du Pont de Nemours & Co., Wilmington, Del., is studying boron-phosphorus polymer protective films. At a recent symposium on organometalloid polymers held at the Research and Development Center of Armstrong Cork Co., Lancaster, Penna., S. Yolles of DuPont's Research Division, Fabrics and Finishes Department gave out some process and performance details. Monoalkyl (aryl) phosphines condense, then form polymers by elimination of hydrogen. These are soluble, in dimethylsulfoxide or dimethylformamide, and form films that don't discolor. Thin films on copper protect the metal against discoloration from the atmosphere for as long as two years.

New Header Introduced

The University of Illinois Small Homes Council has released construction details on a nail-glued header capable of spanning wall openings as wide as 14 inches. Headers for large windows, sliding doors, garage doors, and wide opening and interior parts of the house are available and can be used with either conventional wall framing or panel systems. The headers are composed of 2 by 2 cords and plywood webs fabricated by nail-gluing. They are said to be stronger than other types, but to weigh no more.

Howard A. Smith

E&C Promotes Smith

Howard A. Smith has been named national sales manager of Emerson & Cuming, Inc., Canton, Mass. Mr. Smith joined the firm in 1958 as New England district sales manager. In his new position he will be responsible for all sales efforts for the company including its international representative coverage, regional sales offices, sales promotion and advertising. For two years previous to joining Emerson & Cuming, producer of dielectric materials for the electronic industry, Mr. Smith was a partner in Smith & Purdy Associates, an electronics manufacturers' representative organization covering the New England territory.

Adhesives Patents Guide

An English-language edition of *Gelatine - Lein - Klebstoff - Patentberichte*, an international news letter on adhesives patents, is now available. Entitled *Gelatin-Glue-Adhesives Patent News*, it is published by Hinterwaldner Verlag, P. O. Box 161, Munich 9, Germany. The news letter, which will be mailed to subscribers by air mail, is edited by Rudolf Hinterwaldner, chemist and author of a series of monographs on topics relating to adhesives. The original German-language publication, also edited by Mr. Hinterwaldner, is now in its fourth year.

Pittsburgh Chemical Plant

Pittsburgh Chemical Co., Pittsburgh, Penna., has dedicated its new $4 million maleic anhydride plant at Neville Island, Penna. The plant, scheduled to go on stream early in 1961, will have an annual capacity of 20 million pounds.

TAPPI 15th Conference

The 15th Plastics-Paper Conference, sponsored by the Technical Association of the Pulp and Paper Industry will be at the Hotel Syracuse, Syracuse, N.Y. from October 17 to 19. Five half-day technical sessions are scheduled. Chairmen and sessions are: K. W. Britt (Scott Paper), Wet Strength and Interfiber Bonding; W. N. Stickel (Texon), General Plastics-Paper; G. L. Booth (Black-Clawson), Plastics Coating; H. A. Spencer (Knowlton), Plastics Laminates; and T. A. Howells (Institute of Paper Chemistry), Synthetic Fiber Paper.

Dr. Donald H. Davenport, deputy commissioner of Commerce of New York State, will be guest speaker at the annual banquet. V. T. Stannett, New York State College of Forestry, is general chairman for the conference. R. W. Loheed (Charles T. Main) is chairman of the subcommittee planning the three-day technical program.

Named by Schenectady

John Keramedjian has been appointed group leader of the Adhesives and Rubber Section of the Technical Service Department of Schenectady Varnish Co., Schenectady, N.Y., and in addition to doing laboratory research, he will be available to the trade for consultation on adhesive and rubber-compounding projects involving the use of Schenectady resins. Mr. Keramedjian was graduated from the University of Michigan in 1949 with a B.A. degree, and received a B.S. in Chemistry in 1951. Formerly a member of the Research Section of the Engineering Division of Chrysler Corp., Detroit, Mich., he has concentrated on resins and polymers, with major emphasis on their use in adhesives formulations.

Wezowicz Joins Borden

Edward F. Wezowicz has been appointed technical sales representative for the Polyco-Monomer Department of The Borden Chemical Co., a division of The Borden Co., New York, N.Y. In his new position he will be responsible for the sale in the New York area of the Department's line of synthetic resins, including thermoplastic emulsions, polyvinyl acetate, polyvinyl alcohol, butadiene-styrene and acrylic resins. Mr. Wezowicz was previously associated with E. I. du Pont de Nemours & Co., as a chemist for technical sales.

Trancoa Polyurethane

The new Plastics Division of Trancoa Chemical Corp., Reading, Mass., will specialize in the manufacture of polyurethane resins in a plant designed specifically for that purpose, and will offer a wide line of standard products such as resins for formulation for spray, dip, knife or roll coating. Such adhesives can be air dried or heat cured, and can be applied to metals, wood, fabrics, plastics, rubber, and some vinyls. The company reports that among the useful properties of its urethane resins are: flexibility with hardness, low temperature flexibility, resistance to abrasion, chemicals, solvents, washing and dry cleaning.

The resins find application as concrete patching and bonding materials, binders for abrasive belts, adhesives for several types of flock to various substrates, binders for abrasive particles, adhesives for polyurethane foam to wood and metals, insulating adhesives for epoxy and metal electronic components. Trancoa will also develop custom urethane adhesives for special applications and will manufacture special urethane resins developed by companies not wishing to make them in production quantities. Trancoa has representatives located in different parts of the country.

On National Starch Board

Alfred H. Drewes and Sidney F. Thune have been elected to the board of directors of National Starch and Chemical Corp., New York, N.Y. Mr. Drewes is a vice-president, director, and member of the Executive Committee of National Lead Co. Mr. Thune is vice-president in charge of adhesive and resin sales for National Starch and has been associated with the company since he graduated in 1932 from Worcester Polytechnic Institute with a chemical engineering degree. He has been a manager of the New England, West Coast and Midwestern Divisions of the company. He was appointed an assistant vice-president in 1951 and has been a vice-president since 1952.

3M Stock Split

A 3-for-1 split of the company's common stock was recently approved by the stockholders of Minnesota Mining & Mfg. Co., St. Paul, Minn. In addition, the firm's directors voted to increase the quarterly dividend on split shares to 15 cents. The stock split, which raised the authorized common stock from 25,000,000 to 75,000,000, became effective on May 20, 1960.

New Roberts Distributors

Three new companies have been added to the list of distributors for Anchor-Weld contact bond cement, a product of The Roberts Co., City of Industry, Calif. Presto Trims, Inc., which has locations in Detroit, Grand Rapids and Saginaw, will distribute the contact cement throughout Michigan. The Round & Porter Co., Wichita, Kan., will cover Oklahoma, Texas and Kansas. The Minnesota territory, as well as part of Wisconsin, will be covered by the Kay-Dee Sales Co., Minneapolis, Minn.

NFPA Sponsors Seminar

A seminar on "The Selling Challenge of the Sixties for Packaging Material Executives," sponsored by the National Flexible Packaging Association, the College of Business and Public Service, and the School of Packaging of Michigan State University, was conducted on May 23 to May 25 at the Kellogg Center for Continuing Education, Michigan State University, East Lansing, Mich. The seminar was a participation forum to which all in attendance contributed.

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Fall Containers Meeting

The 10th Corrugated Containers Conference, sponsored jointly by the Technical Association of the Pulp and Paper Industry, New York, and the Canadian Pulp and Paper Association, Montreal, will be held at the Royal York Hotel, Toronto, Ont., October 10-13, 1960. Theme of the first day's program will be "Printing on Corrugated Board." "New Developments in Packaging" will be the subject of the second day's discussions. The final day of the meeting will be devoted to tours of plants in Toronto, Hamilton and surrounding areas.

Advance registrations should be addressed to the Conference at the Royal York Hotel. Further information may be obtained from H. O. Teeple, TAPPI, 360 Lexington Ave., New York 17, N. Y., or R. A. Joss, CPPA, Technical Section, 2280 Sun Life Bldg., Montreal 2, P. Q., Canada.

Borden Names Two

William E. Driscoll has been named Midwest district sales manager for the Polyco-Monomer Department of the Borden Chemical Co., New York, N.Y., and Allan W. Stephens has been transferred to the Western sales organization of the company's Resinite Department. Mr. Driscoll will be responsible for the sale of the Department's full line of synthetic resin products to the paint, paper, textile, leather finishing and packaging industries in the Midwest. He was previously a design engineer at E. I. du Pont de Nemours & Co. Mr. Stephens will be responsible for the sale of industrial plastic extrusions in such centers as San Francisco, Oakland, Sacramento, Salt Lake City, and Denver, also assuming responsibility for special account sales in the Los Angeles area.

Staley Names Hagenbach

Dr. William P. Hagenbach has been named director of engineering research at the A. E. Staley Manufacturing Co., Decatur, Ill. He received his B.S. in chemical engineering at the University of Rochester in 1944, his M.S. at Rochester in 1947, and his Ph.D. at the University of Illinois in 1951. For the past nine years Dr. Hagenbach has been in engineering research with the DuPont Co., where he headed various development engineering projects.

Frank J. Brundage

Promoted by National

Frank J. Brundage has been named New England Division manager of National Starch and Chemical Corp., New York, N.Y., and has assumed responsibility for all product lines of the company. He graduated from Manhattan College in 1938 with a B.S. degree in physics and joined National as a sales representative in 1945. In 1958 he became New York district sales supervisor for the Adhesives Division, going to New England as Northeast Division supervisor later in the year.

National Names Fischer

Irving Fischer has been named New York district sales manager of National Starch and Chemical Corp., New York, N.Y., and will have the added responsibility of supervising resin sales as well as adhesives sales. He holds a B.S. degree in chemistry from the City College of New York and originally joined National as a New York area sales representative. In 1950 he was assigned to the Technical Development Group, and in the following year returned to the Sales Department and was located in Baltimore. In 1958 he was transferred to New York as assistant district supervisor for the National Adhesives Division.

Southwestern Joins HPI

Southwestern Veneer Co., Cotton Plant, Ark., has become a member of the Hardwood Plywood Institute, national trade association of hardwood plywood manufacturers. The company's specialty is the manufacture of veneer and plywood from the Cache River Basin.

New Adhesives Criterion

In commenting on the change in the average packager's approach to adhesive selection over the past decade, Earl C. Lenz, vice-president of sales, Morningstar-Paisley, Inc., New York, N.Y., said that in 1960 the price consideration has been de-emphasized and packagers are choosing adhesives for high performance and efficiency per unit of production because of rising labor costs. In 1950, he said, choice was by invoice price and adequate performance. The newer adhesives, he points out, "are allowing the speed-up of production and minimization of expensive downtime." In addition, packagers are becoming increasingly aware of multi-purpose adhesives which reduce the need for a wide inventory and cut the possibility of choosing a wrong adhesive for a particular purpose, Mr. Lenz remarked.

Reichhold Record Sales

Reichhold Chemicals, Inc., White Plains, N.Y., reports record sales of $23,770,000 for the first three months of 1960, an increase of 6 per cent over the $22,341,000 for the same period in 1959. Net income for the first quarter of 1960 amounted to $663,000 compared with $703,000 for the same period last year. The profit from operations during the first quarter of 1960 showed a 39 per cent increase over the same period in 1959. Net profit excluding gains on sales of investments for 1960 was $645,000 compared to $464,000 for the same quarter in 1959. Earnings per shares outstanding at the end for the first quarter of this year were 17.9¢ per share compared to 21.7¢ per share for the same period in 1959.

3M Earnings Mount

First quarter sales of $128,669,218 and earnings of $16,217,911, equal to 95¢ per share, have been announced by Minnesota Mining & Manufacturing Co., St. Paul, Minn. The first quarter figure, which includes the operations of the foreign subsidiaries, compares with sales of $115,172,320, and earnings of $13,956,520, or 82¢ per share for the first quarter of 1959. Herbert P. Buetow, company president, pointed out that consolidated sales for this year's first quarter are about 11 per cent ahead of those for the like period last year, and that foreign sales are continuing to grow.

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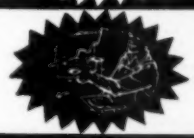

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Trowellable for sealing cracks in walls, concrete pipe, gelcoating of molds and patterns, gloss coating, sheet metal bonding and sealing

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Sees Packaging Growth

The packaging industry will double in size in the 1960's, growing from an annual volume of about $16 billion at the beginning of the decade to $35 billion at its close, predicted T. W. Sharp, director of product marketing for Union Carbide Plastics Co., New York, N.Y., at the 29th National Packaging Exposition of the American Management Association in Atlantic City, N.J.

"This growth will be necessary to keep pace with the tremendous increase in our national production potential," Mr. Sharp said. The next decade, he believes, will find the automating of production in full bloom and agricultural production at new highs. He does not feel that the marketing arm of industry, of which packaging is a vital part, is as advanced. The vitality of the 1970 economy will depend in a very real way on the packager's ability to build the same efficiency into merchandising that automation will build into manufacturing, and scientific methods will inject into manufacturing, he feels.

Armour Builds Lab

Construction of a new Armour Industrial Chemical Co. research laboratory designed to provide improved road building chemicals, new plastic and textile products, and better gasoline and fuel oil additives, among other products, is under way in McCook, Ill. Ground has been broken for a one-story laboratory and a pilot plant. M. E. Lewis, general manager of Armour Industrial Chemical, said the new facilities will permit intensified research programs, pointing out that Armour Industrial Chemical Co. will be responsible for product development and technical service as well as fundamental research now that Armour and Company has decentralized its research activities.

Reichhold Signs Pact

Deutsche Erdol A.G. and Reichhold Chemie A.G., Hamburg, Germany, have signed an agreement for the joint manufacture of raw materials used in the production of various Reichhold products. A new company will be formed with facilities at Brunsbuttelkoog, close to the DEA refinery in Hemmingstedt, and convenient for handling of water shipments to RCI affiliates in other countries. Production is set for early in 1961.

Borden Appoints Three

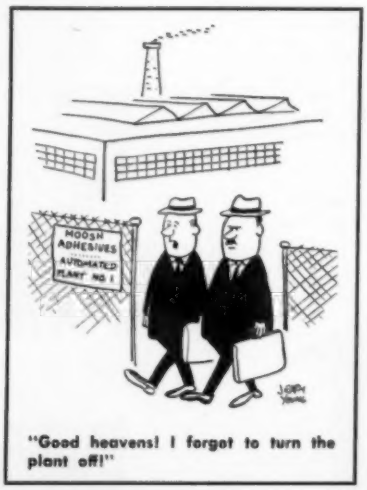
The Borden Chemical Co., a division of the Borden Co., New York, N.Y., announces the following appointments:

Gilbert L. Hembree has been named a technical sales representative for the company's Polyco-Monomer Dept. He will be responsible for the sale in Wisconsin, Minnesota and Upper Michigan of the company's line of synthetic resins.

Gene R. Foust was appointed sales service representative for Borden's Resins and Chemicals Dept. Mr. Foust will handle the sale of the company's resin and adhesive products to the wood, paper, foundry and allied industries in the Southeast. Responsibility for the sale of these products in the Midwest goes to Don F. Hillmer, who was recently appointed to the position of sales service representative.

Novolac Resin Introduced

A new stable novolac resin developed especially for hot-processed sand coating has been introduced by Union Carbide Plastics Co., New York, N.Y. The material, Bakelite phenolic resin BRR-7151, is said to accelerate production speed. According to the company, superior hot strength of BRR-7151 allows for faster cures and freedom from shell warping or cracking, and melt viscosities of the resin provide the best flow for higher shell or core strength, ideal shell weight pick-up in rapid investment cycles, and optimum green strength on pattern plates. The resin is recommended by the company for all types of hot coating equipment.



"Good heavens! I forgot to turn the plant off!"

Thiokol-Based Adhesives

An adhesive combination of polysulfide liquid polymer and epoxy resin designed for facilitating concrete repairs was demonstrated recently by Thiokol Chemical Corp., Trenton, N.J. The company revealed that extensive testing over a six year period has shown that the polysulfide-epoxy mixture provides an overlay bond that was previously thought to be impossible.

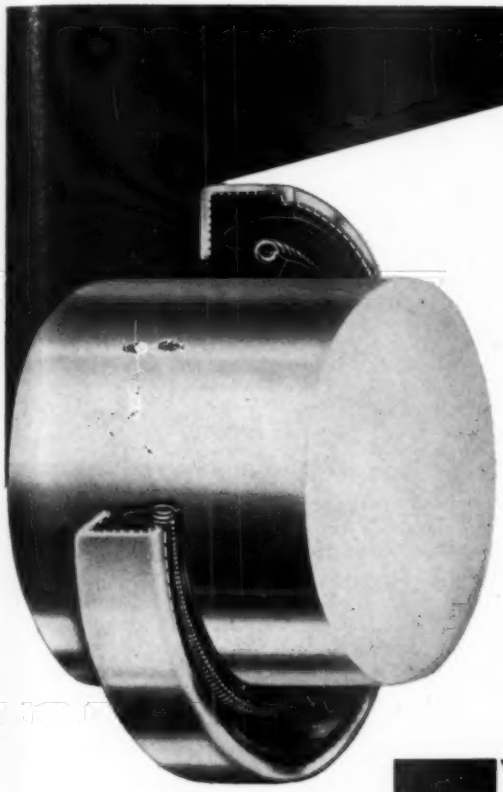
The adhesive was originally developed by the Materials and Research Department of the California Division of Highways for bonding traffic line markers to Portland cement or asphaltic concrete pavement. Further work and tests established that similar formulations were useful for bonding fresh concrete to cured concrete, old concrete to old concrete, and making a mortar for patching and grouting applications.

Reports Staley Growth

At the annual meeting of stockholders of the company, A. E. Staley, Jr., chairman of the A. E. Staley Manufacturing Co., Decatur, Ill., said that the merger of the U.B.S. Chemical Co., Cambridge, Mass., into the Staley Company, which took place a year ago, is working out well, and that new synthetic polymer products of the Division are developing markets in the paints and other industries. Staley's major research expansion program, begun four years ago, has a number of new products and processes under development, he said, which are expected to widen markets for the company's corn, soybean and chemical products. A new 108,000 square foot research center at Decatur, designed to house expanded research activities, will be ready this summer.

Borden Quarter Earnings

First quarter earnings and sales of the Borden Co., New York, N.Y., set new all-time highs for the period. Earnings for the first three months of 1960 rose 20.3 per cent over the comparable 1959 period. They totaled $5,445,618, equal to 55¢ a share, as against $4,525,822, or 47¢ a share a year earlier. The 1959 figures are adjusted for the two-for-one stock split voted January 5. First quarter sales totaled $230,012,995, an increase of 4.25 per cent over the $220,644,746 total for the comparable 1959 period. Figures are subject to audit and year-end adjustments.



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names in the news

Arthur R. G. Williams, managing director of National Adhesives, Ltd., English subsidiary of National Starch and Chemical Corp., New York, N.Y., has been elected president of the Adhesives Manufacturers Association of England.

Dr. George Sosnovsky, who joined Armour Research Foundation, Chicago, Ill., last year, has been promoted to the post of senior chemist.

Dr. James R. Dudley, vice-president of research and development at the Richardson Co., Melrose Park, Ill., has been elected president of the Commercial Chemical Development Association.

Thomas L. Trafford has been appointed engineering manager for the Resins & Chemicals Department of the Borden Chemical Co., division of the Borden Co., New York, N.Y.

Dr. Carl F. Prutton, executive vice-president of Food Machinery and Chemical Corp., New York, N.Y., received an honorary degree of doctor of engineering from Clarkson College of Technology.

John E. Griffith, formerly technical assistant to the superintendent of the Coating Department of Riegel Paper Corp., located at the company's Milford, N.J. plant, has been appointed a technical industrial sales representative.

James H. Christopher, Jr., has been named sales manager for the Coatings and Adhesives Department of the Borden Chemical Co., New York, N.Y. **Robert E. Munsell** has been appointed northeast regional sales manager, and **Seymour D. Kirsch** has been named development manager.

Justin A. Lewis, Jr. has been named sales manager for barium and magnesia products at the Mineral Products Division of Food Machinery & Chemical Corp., New York, N.Y.

Roland Grey, formerly with Continental-Diamond Fibre Corp., has been appointed head of a new product development group at Tri-Point Plastics Inc., Albertson, N.Y.

Keith Holmes, formerly with DuPont of Canada, has joined Armour Industrial Chemical Co., Chicago, Ill., as eastern Canadian sales representative.

William L. Lawrence has joined Catalin Corp. of America, as a research chemist in the company's central research laboratories, Fords, N.J.

F. O. Boylon has been appointed vice-president, manufacturing, at Crown Zellerbach Corp., San Francisco, Calif.

Robert F. Ginn, Daniel E. Kane, Raymond H. Fowler, and **Florian J. Zukas** have joined the research and development laboratory of National Vulcanized Fibre Co., Yorklyn, Del., as chemists.

David M. Stettler has been placed in charge of sales and service on national accounts in the metropolitan New York and New England areas for Colton Chemical Co., and is located at the company's new New York City sales office.

Roy S. Fisher has been appointed administrative vice-president of National Vulcanized Fibre Co., Wilmington, Del., and will be in charge of sales, marketing, traffic, industrial relations, and order service departments.

Vern I. McCarthy, Jr., president of Vulcan Containers Inc., Bellwood, Ill., has been named to the board of trustees of the School of Packaging Foundation at Michigan State University, Lansing, Mich.

Wesley M. Dixon, president, Container Corp. of America, Chicago, Ill., has been named chairman and chief executive officer of the company.

Lance A. Wise has been named assistant public relations director of the A. E. Staley Manufacturing Co., Decatur, Ill., and editor of the "Staley Journal."

William Van Natta

Appointed by National

William Van Natta was named district sales manager of the Structural Products Division, National Starch and Chemical Corp., New York, N.Y. He will be responsible for sales in New York, New Jersey, Pennsylvania, eastern Ohio and Maryland. Mr. Van Natta has been instrumental in developing markets for Granite Board and Parflake, two of National's wood particle board products.

Jackson B. Browning has been named a vice-president of Union Carbide Development, New York, N.Y.

Ralph L. Gray has been elected to the Board of Directors of Spencer Chemical Co., Kansas City, Mo.

John F. O'Brien has been appointed technical field sales representative in Southern California for Hysol of California, a division of Hysol Corp., Olean, N.Y.

Dr. Brandes H. Smith has joined the Chemicals Research Division of Esso Research & Engineering, Linden, N.J., as research chemist in an exploratory group.

Thomas F. Dolan, founder of the Dobeckmun Co., Cleveland, Ohio, will retire after 33 years as president of the company. He will be succeeded by **John C. Staudt.**

Lester F. Borchardt has been appointed managing director of the Central Research Laboratories of General Mills, Inc., Minneapolis, Minn.

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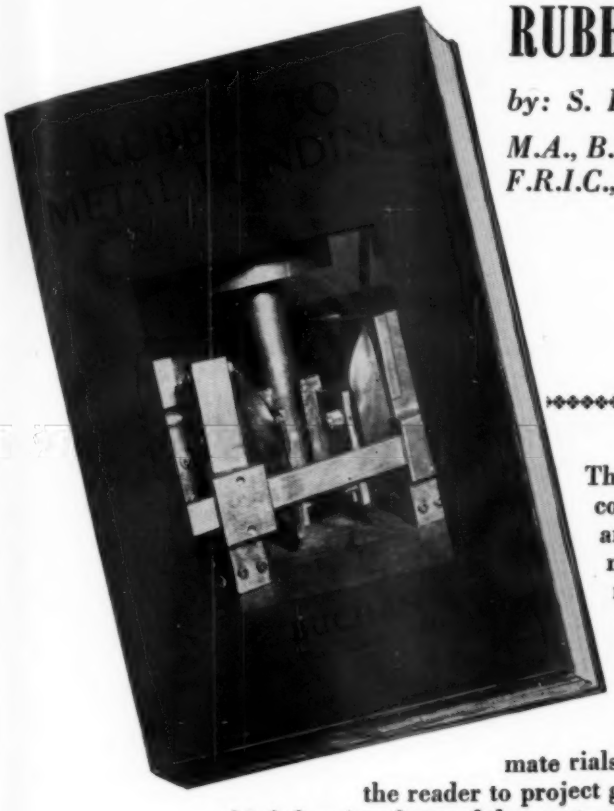

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by: S. Buchan

M.A., B.Sc. (Aber.), Ph.D. (Cantab), F.R.I.C., A.I.R.I.

1959, 296 pages, with bibliography

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This new edition of Dr. Buchan's important and comprehensive work, has been completely revised and up-dated to include the many advances and new developments in the technology of bonding rubber-to-metal in the 10 years since the publication, in 1948, of the widely-acclaimed original edition. Describes processes, applications and methods in detail. Gives concise, straight-forward explanations of how to handle rubber-to-metal bonds at each stage of the job. Sufficient mate rials are included with each description to permit the reader to project given examples to his own needs. Written by the chief chemist of one of the most successful bonding firms in the world, this is the single most complete source of information about a subject of major technical importance to men working in the rubber adhesive industries.

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June 27-July 1. Massachusetts Institute of Technology, Course on Adhesive Joints, Cambridge, Mass.

July 4-8. Sawmilling and Wood Machinery Convention, Olympic Stadium Exhibition Building, Melbourne, Australia.

July 11-15. Gordon Research Conferences, Statistics in Chemistry and Chemical Engineering, New Hampton School, New Hampton, N.H.

July 13-16. Silver Bay Conference on Human Relations in Industry, Silver Bay, New York.

July 18-22. Gordon Research Conferences, High Pressure Research, Kimball Union Academy, Meriden, N.H.

July 19-21. Western Packaging and Materials Handling Exposition, Pan Pacific Auditorium, Los Angeles, Calif.

July 25-29. 13th International Congress on Occupational Health, Waldorf-Astoria Hotel, New York, N.Y.

Aug. 1-5. Gordon Research Conferences, Instrumentation, Colby Junior College, New London, N.H.

Aug. 1-5. Gordon Research Conferences, Solid State Studies in Ceramics, Kimball Union Academy, Meriden, N.H.

Aug. 7-13. Columbia University Industrial Research Conference, Arden House, Harriman, N.Y.

Aug. 8-12. Gordon Research Conferences, Chemistry and Physics of Solids, Kimball Union Academy, Meriden, N.H.

Aug. 8-12. Gordon Research Conferences, Organic Coatings, New Hampton School, New Hampton, N.H.

Aug. 14-17. American Society of Mechanical Engineers-American Institute of Chemical Engineers, Joint Heat Transfer Conference and Exhibit, Statler Hilton Hotel, Buffalo, N.Y.

Aug. 15-25. International Symposium on the Chemistry of Natural Products, Melbourne, Sydney and Canberra, Australia.

Aug. 18-19. Electronic Packaging Symposium, University of Colorado, Boulder, Colo.

Aug. 24-27. Technical Association of the Pulp & Paper Industry, Forest Biology Conference, Seattle, Wash.

Aug. 27-30. National Association of Furniture Manufacturers, 32nd Annual Convention & 6th Annual Supply, Equipment & Fabric Fair, Conrad Hilton Hotel, Chicago, Ill.

Aug. 28-Sept. 6. Third Materials Handling Exhibition, Oslo, Norway.

Aug. 29-Sept. 2. Gordon Research Conferences, Adhesion, New Hampton School, New Hampton, N.H.

Aug. 29-Sept. 2. Gordon Research Conferences, High Temperature Chemistry, Kimball Union Academy, Meriden, N.H.

Aug. 29-Sept. 10. World Forestry Congress, Seattle, Wash.

Sept. 7-9. American Society of Mechanical Engineers, Instrument and Regulators Conference, Massachusetts Institute of Technology, Cambridge, Mass.

Sept. 10-17. Fifth International Instrument and Measurements Exhibition and Conference, Stockholm, Sweden.

Sept. 11-14. Produce Packaging Exposition, American Hotel, Miami Beach, Fla.

Portrait Of

D. A. GEORGE

As project leader of the Adhesives Group, National Bureau of Standards, Desmond A. George supervises and directs research, developments, testing programs and the writing of specifications on adhesives and sealants.

Mr. George is author and co-author of some 25 NBS Reports on the development of non-metallic springs, structural epoxy adhesives, elastomers, sealants, and the creep behavior of solid propellants. At present he is working on projects investigating the working, chemical and physical properties of polysulfide sealants; heat sealing of plastic films; variations in surface electrical resistance of nylon at various humidities, and the effects of rate of loading on the ultimate strength of adhesive bonded lap-shear joints.

A graduate of Stephen F. Austin College, from which he received a B.S. in 1941, Mr. George has taken undergraduate courses in physics and graduate courses in chemistry from George Washington University. He joined the NBS in 1942 and has been with them since with the exception of a three-year tour in the U.S. Navy during which time he saw action in the Okinawa campaign.

Mr. George has been extremely active in various technical associations. At present he is chairman of the Subcommitte of Adhesives for Plastics of ASTM's Committee D-14.

Phenolic Resin Modifier

Poly-phen L-118, a phenol formaldehyde resin especially designed for modifying the properties of polyvinyl acetate, has been introduced by National Polychemicals, Inc., Wilmington, Mass. The resin, highly reactive and water-soluble, according to the company, improves the resistance of polyvinyl acetate to high temperature, water and a variety of solvents. It is said to reinforce the physical properties of the polymer and to reduce its cold flow characteristics. It is believed to cross-link with polyvinyl acetate and to some extent impart thermosetting characteristics to the polymer, and shows promise of being able to modify a wide variety of other water-dispersed polymeric systems, the company reports. A technical bulletin, NPL-100C, and samples are available.

National Introduces Resin

National Starch & Chemical Corp., New York, N.Y., has announced a new latex form of polyvinylidene chloride resin called Resyn 3600 and is building a special facility to produce it at the company's plant in Meredosia, Ill. The installation, expected to go into production in the fall, will have a capacity of 14 million pounds per year. The new latex reportedly is highly stable and, used as a coating material, combines outstanding barrier and protective properties. According to National, the resin can be applied at low cost to a variety of porous and non-porous substrates by standard coating equipment. It is said to have extreme resistance to transmission of water vapor and common gases.

FMC Considers Tract

Food Machinery and Chemical Corp., New York, N.Y. is considering purchase of a 600-acre tract of land near Mount Vernon, Ala., as a possible site for a multimillion-dollar chemical plant. The company is drilling and exploring to determine if there are enough salt deposits on the land to make it worthwhile in exercising its option to purchase.

Sisalkraft Sales Up

American Sisalkraft Corp., Attleboro, Mass., has reported 1959 sales of $15,043,552 as compared with $13,192,240 in 1958. Net profit for last year was $824,710 in comparison with the 1958 figure of $605,802. The adjusted net income for 1959 was $1,100,392, compared to $750,417 in 1958.

Borden Rug Backing

Borden Chemical Co., New York, N.Y., has announced it will place a new consumer product, designed as a home-applied rug backing compound for scatter rugs that skid, in national distribution this year under the name of Elmer's Floor Grip. It will be packaged in four- and eight-ounce polyethylene squeeze bottles with one inch spreader applicators for both sizes. Floor Grip is also recommended for general use as a non-slip coating. Test marketing is underway, and Borden expects to begin national distribution in the fall. The company states that the product has excellent adhesion to rugs but that it will not stick to floors. It is said to be harmless to fabrics, floors and woodwork, and to withstand repeated washings.

Staley Profits High

A. E. Staley Manufacturing Co., Decatur, Ill., reports net earnings of $1,181,404 for the three months ended March 31. Combined with a net profit of $1,368,820 in the first quarter of the company's year, the six months' income is at $2,550,224. The net profit for the preceding six months was $2,345,312 and for the first half of the previous fiscal year, $3,392,333, was restated to include U.B.S. Chemical Company, Cambridge, Mass., which became a Staley division on June 30, 1959. Earnings per share for the six months ended March 31 were $1.20 compared with $1.11 for the preceding six months and $1.64 for the like six months a year ago.

Biddle Moves Plant

Biddle Co., St. Louis, Mo., recently moved its offices, research, and manufacturing facilities to a new, one-level plant at 2817 Breckenridge Industrial Ct. The plant is designed for manufacturing putty, caulk, glazing compounds, sealants, and mastics. Loading, storage, manufacturing, and packaging facilities are about triple those of the previous location. New processing machinery and material handling equipment has been installed.

Adhesives Booklet Out

"New Adhesives" is a pamphlet made available by Adhesive Products Corp., 1660 Boone Ave., New York, N.Y., which stresses latest solutions for adhesive problems. It discusses adhesives for vinyl, polyethylene, polyurethanes, Mylar, wood, metal and glass.

BOND IN BOTTLES

Well... not really in bottles. But, now you can get Super-Strength LEFKOWELD 2-Component Paste Type Adhesives in handy, disposable, high-grade polyethylene kits*. LEFKOWELD is accurately *pre-proportioned* for you. Clean, safe, convenient blending of adhesive and activator. Your hands are safe from irritating chemicals. Just a few simple steps and LEFKOWELD is ready to apply. Newest! Safest! Fastest! and Easiest! way to apply adhesives...the LEFKOWELD Adhesive Kit.

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LEFFINGWELL CHEMICAL COMPANY

patent review

By MELVIN NORD

Adhesive Lamination of Fiber Insulation Board

U. S. Patent 2,926,722, issued March 1, 1960 to Edgar A. Lauring and assigned to Minnesota and Ontario Paper Co., describes a process of laminating fiber insulation board with a foamed adhesive material.

The foamed adhesive is prepared from waste sulfite liquor. Into waste sulfite liquor there is stirred five per cent of lime, adjusting the pH to 8.5-9.0. The lime added neutralizes the acid and begins the precipitation of the ligno sulfonates from the waste liquor. The lime is added as a 33 per cent slurry.

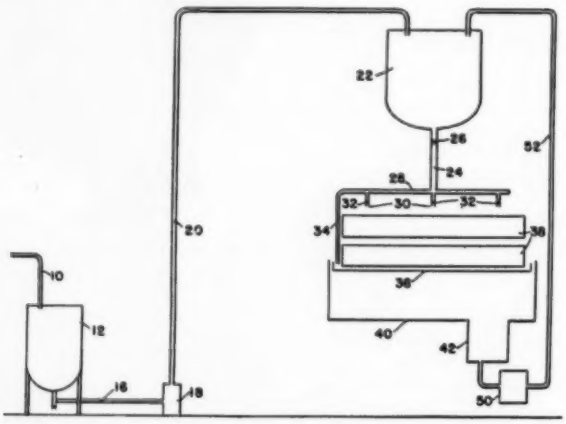

Figure 1

As shown in Figure 1, the foaming tank (12) receives waste sulfite liquor and other material through a conduit (10). After the adhesive has been prepared, the pump (18) removes the adhesive from tank to a conduit (16) and discharges the adhesive through a line (20) into a circulating tank (22). The adhesive from the circulating tank passes through a pipe (24) where the flow is controlled by a valve (26). The adhesive from the pipe (24) is received by a header (28) and a part of the adhesive from the header passes through outlets (30) under the control of valves (32). Part of the adhesive from the header flows through a pipe (34) to a pan (36) from which it is picked up by adhesive applying rolls. Rotatably mounted on suitable bearings are adhesive applying rolls (38).

An excess of adhesive should be applied to the fiberboard and the excess from the fiberboard flows into a container (40) and from there into a sump (42). The adhesive should be maintained one or two inches above the top of the sump so that air is not drawn into the adhesive. The addition of air at this point would result in the collapse of the bubbles or foam in the adhesive.

A suitable float mounted in the sump and operatably connected to the pump (50) will prevent the adhesive from getting too low in the sump and the incorporation of air at this point. The adhesive from the sump is pumped through a pipe (52) back to the circulating tank (22).

Copies of any patents, including those described here, are available from the Commissioner of Patents, Washington 25, D. C., for 25 cents each. Do not send stamps.

Mucilaginous Composition

U. S. Patent 2,923,692, issued Feb. 2, 1960 to Joseph F. Ackerman and John F. Jones, assigned to The B. F. Goodrich Co., describes the preparation of smooth, non-graining, high viscosity, mucilage-like compositions from a salt of a water-sensitive but water-insoluble cross-linked polymer of an olefinically unsaturated carboxylic acid monomer such as acrylic acid.

The polymer is first prepared by polymerization in an organic medium in which the monomer is more or less soluble but in which the polymer is not substantially swelled, *e.g.*, an aliphatic or aromatic hydrocarbon. The polymer is then mixed with water and neutralized *in situ* with ammonium hydroxide to form the polymer salt. The salt is then dispersed in water to permit maximum swelling and to blend and colloidally disperse it and effect its conversion to a smooth, non-graining mucilaginous composition of maximum viscosity.

Polyethylene Adherent to Metal Surface

U. S. Patent 2,910,384, issued Oct. 27, 1959 to Harry A. Toulmin, Jr., assigned to the Commonwealth Engineering Co. of Ohio, describes a method of making polyethylene adherent to a metal surface.

The polyethylene is mixed with 1-20 per cent by weight of a blend of organic solvent benzyl dextran and an ester of a dextran or dextran conversion product with a fatty acid containing 8-18 carbon atoms and which is dissolved in a common volatile solvent for polyethylene, *e.g.*, toluene. By thus modifying the polyethylene a coating composition is provided which, on application to metal surfaces and baked at 200 to 300° C. until the film becomes insoluble in a solvent for the untreated polymer, forms a tough, tenaciously adherent durable film.

Asphalt Adhesive Composition

U. S. Patent 2,923,638, issued Feb. 2, 1960 to Arnold J. Hoiberg and Charles E. Cowger, assigned to Monsanto Chemical Co., discloses an asphaltic adhesive composition which is particularly adapted for adhering sheet metal foil such as aluminum to roofing structures, metal tanks, etc.

The adhesive consists of 7-12 per cent of a short-fibered asbestos mineral filler in a cut-back vehicle prepared in a way specified in detail in the patent.

Mechanisms for Applying Hot Adhesives

U. S. Patent 2,926,723, issued March 1, 1960 to Alfred S. Clark and assigned to United Shoe Machinery Corp., describes adhesive-handling mechanisms for applying a hot adhesive material which aids in forming a seam or bond between thin unsupported films of plastic material such as polyethylene. The adhesive material consists of a polyethylene type of adhesive containing other resins, in which the temperature of the melted adhesive is substantially above the melting point of the film and in which the quantity deposited carries sufficient heat to melt the surface portions only of the film to cause amalgamation, *e.g.*, a mutual solution of the adhesive and surface portions.

Since the temperatures required to effect a satisfactory bond are in the neighborhood of 325° to 375°F., it will be seen that the applying apparatus must be heated to a temperature somewhat in excess of this range of temperatures to avoid chilling the material before it is applied and that such temperatures are sufficiently high to very quickly melt the polyethylene film in case of accidental contact between the latter and a nozzle, for example. Accordingly, in the machine described, the device for applying the adhesive comprises a heated nozzle arranged to extrude a thin, narrow stream of hot material upon the fast running web without any contact between the material and the nozzle.

Figure 2 shows the applying nozzle (50) for the cement, together with an antidrip device associated with it.

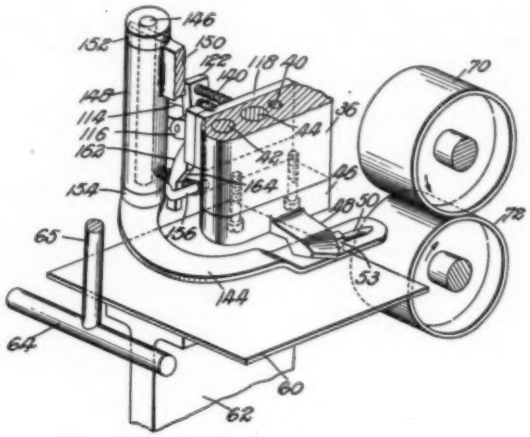

Figure 2

Other Patents of Interest

Subject	Inventor or Assignee	Patent No.	Date
Adhesive bandage envelope	The Kendall Co.	2,924,331	2/ 9 /60
Covered tape dispenser	Carl A. Dahlquist	2,924,365	2/ 9 /60
Tape dispensing and cutting device	Clarence W. Vogt	2,924,366	2/ 9 /60
Binder for foundry molds	Diamond Alkali Co.	2,926,098	2/23/60
Pressure-sensitive adhesive tape	Minnesota Mining & Mfg. Co.	2,926,105	2/23/60
Paper product containing anionic polyamide resin suspensoid	General Mills, Inc.	2,926,117	2/23/60
Tape dispenser	John H. Park	2,926,807	3/ 1 /60
Labelling apparatus	Long & Co., Inc.	2,926,808	3/ 1 /60
Fibrated mastic coatings	The Patent & Licensing Corp.	2,927,038	3/ 1 /60

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new equipment

Internal Mixing Spray Gun

Featuring instantaneous internal mixing of plural component materials, the Turbulator spray gun is designed for materials such as those used for linings of storage tanks, grain and silage bins and for refrig-

erated railroad cars; coatings for use in structural steel work, special equipment and machinery; structural resins used in the manufacture of boats, caskets, swimming pools; plastic foams for refrigeration and other insulations, flotation equipment and sandwich structures; and other coatings widely used in the appliance, automotive, aircraft and missiles industries. The Turbulator spray gun is used with a Formulator which gives controlled metering and perfect mixing. According to the manufacturer, the spray gun can also be used as a pouring instrument and combines the plural component materials internally and dispenses the combined ingredients as a mixed and accurately metered end material. This end material can be atomized for spray or directly poured. The gun is a high energy internal mixer designed for hand or automatic dispensing. *Binks Mfg. Co.* **E-200**

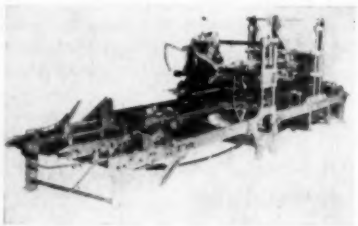
Triangular Guide Line Tape

Permacel PSR-2800, a triangular guide line tape for insulating of form-wound motor coils is made of self-bonding unsupported silicone rubber. Because of its triangular cross-sectional shape, PSR-2800 can be half lapped around complex shaped coils and wires to give a smooth, ridge-free and void-free build-up. A center guide line insures an easy and uniform wind and eliminates gapping in the wrap. Various tape thicknesses are identified quickly by color coding the guide lines.

PSR-2800 is a Class H insulator and is reported to have excellent chemical, dielectric and physical stability over a temperature range of −130°F. to +500°F. While primarily a coil wrap, PSR-2800 is also recommended for field repairs of electrical Class H equipment; wrapping bus bars and stator coils; electrical coils which are temperature sensitive and complex cable harnesses. PSR-2800 bonds itself under normal contact pressure, and strength is built up under aging at room temperatures. Bond strength can be improved by post-curing for several hours at accelerated temperatures. *Permacel.* **E-201**

Combination Sealer

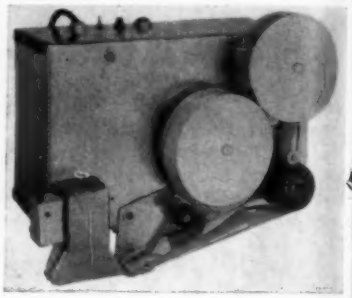
The combination sealer enables those who ship in corrugated cartons to seal some cases with glue and other cases with gummed tape. This



ability to shift from one method of sealing to another is an important assist to manufacturers who can use the economies of straight gluing for most cartons, but, because of special problems or postal regulations, need to tape seal other cartons frequently, the manufacturer states. The basic machine consists of the manufacturer's Standard-Type 429 Gluer and Sealer, which comes equipped for sealing cases with glue. It is converted to a dual purpose machine by adding a Model M-10 Tape-Line system that automatically moistens, measures, cuts and applies gummed tape. *Emhart Mfg. Co.* **E-202**

Label Applicator

A new label applicator, Label-Aire operates on an air jet principle in applying pressure-sensitive labels. Completely automatic, the unit picks up labels, as they are peeled off the backing strip, by an incoming air jet. The air jet then reverses itself and each label is positioned on the product or package by jet action with the exactness of a rifle shot, the manufacturer states. The label applicator will handle any type of label from ½ inch to 3 inches wide, whether it is die-cut or knife-cut. It will operate at any



production line speed up to 155 feet per minute and can be installed easily in a production line by a plant maintenance crew. According to the manufacturer, the unit also can be mounted either horizontally, or vertically, with the loading side always accessible regardless of the direction of the production line. Construction is of stainless steel, and the unit operates on 115 volts AC, 60 cycle current. *Kleen-Stik Products, Inc.* **E-203**

Impulse Sealer

The Weldotron Sealboy impulse sealer utilizes a rapid heating and cooling action to achieve optimum seals with no skill required on the part of the operator. The rapid heating effect is achieved by pulsing a thin ribbon of high temperature alloy with a high current for a short time interval. After the heating current is cut off, the extremely low thermal capacity of the alloy ribbon results in an effective reversal of heat flow, and a rapid resultant cooling action. Though designed primarily for polyethylene sealing, the unit will heat seal such films as Saran and vinyl. The Weldotron Sealboy is 12½ inches long by 4 inches wide, has a sealing length of up to and including 8½ inches, and a sealing time of ½ to 2 seconds, depending on film thickness. *Plastic Welding Corp.* **E-204**

Label Marker

Model 20W label marker marks sew-in labels, as well as pressure-sensitive and gummed labels, and features a newly-designed turn wheel register. The unit provides more marking area on labels and permits the use of labels up to 1 inch by 1⅞ inches. The custom-made turn wheel

register offers two lines of dial marking with up to 7 characters per line. In addition, it allows for one line of type at the top of the label for relatively constant information such as season coding, department numbers, etc. The register is made with steel engraved wheels that will last the life of the machine and is available in four different type faces. *Soabar Co.*

E-205

Tape Dispenser Package

The Tape-Saver dispenser is said to give tapes maximum protection against dust, dirt, ashes, etc., and its rigid sides prevent crushing. The manufacturers line of precision-slit, pressure-sensitive charting and drafting tapes, ranging in width from 1/64 to 2 inches is now being packaged in the Tape-Saver dispenser. The dispenser feature makes application of the tape easier and more accurate, the company states, and the tape end is always accessible. Tapes can be identified at a glance through the clear plastic sides and also by an identifying strip in the center. Sides can be snapped apart to remove tape. Storing is made easier because the flat sides of the dispenser allow stacking. In addition, a punch-out center section provides for spindle storing. *Chart-Pak, Inc.*

E-206

Label Printing Machine

The Dual-50 Label printing machine prints from either a rubber mat with changeable rubber type or stencil drum. The unit cuts to size and counts and stacks labels automatically at the rate of 105 labels per minute. Label stock includes gummed, ungummed or pressure-

sensitive, in any size from ½ inch by 2 inches to 4⅛ inches by 6 inches. The label printer weighs 44 pounds and occupies a 9 inch by 20 inch table space. The printer can be adjusted in seconds to satisfy requirements for different sizes and varieties of labels for use in shipping, production, packing and inspection. *Weber Marking Systems, Inc.*

E-207

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book reviews

Metallizing of Plastics. ***By Harold Narcus. Published by Reinhold Publishing Corp., 430 Park Avenue, New York 16, N.Y. 5x7½ in. 208 pp. $5.50.***

Though there have been many technical articles printed on procedures for metallizing insulating materials or so-called "nonconductors," this is probably the first attempt at a text which offers practical and tested methods for employing the various known processes. The author, who is president and technical director of Electrochemical Industries, Inc., draws heavily on his own experience with processes that have been utilized in actual production at his plant. The emphasis throughout the book is on the "practical" and Mr. Narcus purposely avoids going into extended technical details.

Special chapters are devoted to methods such as chemical reduction, vacuum metallizing, cathode-sputtering, silver-spray and electrodeposition. A catch-all section treats processes employing conductive paints, metal spraying in mold production, gas plating and conductive plastics.

Though not too long ago the application of metallic coatings to nonconductors was used for primarily decorative purposes, these techniques have now become important in the production of aircraft, rocket, missile and other industrial components. They have been found to eliminate undesirable properties of the synthetic resin, produce a product which has the properties of the deposited metal as well as those of the plastic, and make possible the utilization of scrap plastic materials. This book tells why and offers some formulas that have been successfully used by the author and others active in this field.

The Chemistry of Acrylonitrile. ***Second Edition. Petrochemicals Dept., American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N.Y. 6x9¼ in. 272 pp.***

Since this book was first published in 1951, acrylonitrile has grown in importance as a result of the development of applications in the fields of plastics and surface coatings. This new edition not only brings the references up to date, but provides a complete section of tables on reaction conditions, yields, and literature references for many of the presently known reactions of acrylonitrile.

In the field of adhesives, we know that acrylonitrile-butadiene rubbers can be formulated into bondants which are particularly suited to bonding synthetic rubber stocks to metal. In addition these formulations have shown themselves to be resistant to aliphatic and aromatic solvents, as well as most plasticizers that generally cause bond failure with other adhesives.

The literature cited in this volume points up the use of these adhesives in the shoe, packaging, plywood, textile and other industries. Limited copies of the book are available without charge from American Cyanamid. Requests must be made on company letterheads.

Analytical Chemistry of Polymers. Part I. Analysis of Monomers and Polymeric Materials: Plastics—Resins—Rubbers—Fibers. ***Edited by Gordon M. Kline. Published by Interscience Publishers, 250 Fifth Ave., New York 1, N.Y. 6x9 in. 666 pp. $16.50.***

Eleven previous volumes in the Interscience high polymer series dealt with the physical chemistry of these materials and the mechanisms of polymeric processes. The present collection of twenty essays by chemists from top U. S. companies in the field brings together descriptions of analytical methods that had been available only in research reports scattered through the technical literature, in unpublished company specifications, or in laboratory manuals. The editor, an official of the National Bureau of Standards, has succeeded in assembling authoritative accounts of methods for assay and impurity determination in monomers, as well as characterization and determination of chemical and physical properties of polymers.

The wide range covered by the contributors is indicated by the chapter headings: (1) Acrylic Plastics, (2) Alkyds, (3) Amino Resins, (4) Cellulose Derivatives, (5) Epoxy Resins, (6) Ethylene and Fluoroethylene Polymers, (7) Furan Resins, (8) Natural Resins, (9) Phenolic Resins, (10) Polyamides, (11) Polyesters, (12) Proteins, (13) Rubbers (Elastomers), (14) Silicones, (15) Styrene Monomers and Polymers, (16) Vinyl Polymers and Copolymers, (17) Ion Exchange Resins, (18) Plasticizers, (19) Synthetic and Natural Fibers, and (20) Drying Oils.

Willard P. Tyler of the B. F. Goodrich Research Center, in writing the chapter on elastomers, has achieved an excellent balance between a description of analytical methods and a critical evaluation of their applicability. Although his primary purpose was to present control and specification methods for crude and vulcanized natural and synthetic rubbers, he has also selected a number of test techniques of value in studying a particular type of polymer. A wealth of reference material was appended to permit an analyst to perform any of the reported tests.

Analytical chemists and other persons responsible for quality control in the resin and rubber fields will discover a mine of valuable technical information in this book. It is also recommended for students and technical personnel in user industries, such as adhesives, plastics, textiles, paper and protective coatings.

Trade Literature

Adhesive Applicator. A new 4-page folder on tape application, "Tape Closures with Therogrip" illustrates and provides specifications for the Thermogrip Applicator Model DN with an accessory tape folding device. Two schematic drawings in the literature show the sequence of operations. Listed are a number of advantages available to bag makers who will use the new hot-melt system including cost reduction, a clean and easily maintained adhesive system, increased production rates, and superior quality closures. *United Shoe Machinery Corp.* **L-239**

Specification Adhesives. "How To Buy Adhesives for Better Adhesion" is an eight-page booklet that lists 23 basic yardsticks that let you know in advance when you have the right adhesive. The literature points out that for each application of an adhesive—in the making, packaging, labeling and shipping of a product—there is only one specific adhesive formula that best meets all requirements in both purpose and method of application. *Arabol Mfg. Co.* **L-240**

Story of Starches. A 66-page booklet which presents a panoramic picture of starches—their properties, production, applications and handling. The booklet discusses commercial raw starches; well known specialty starches; newer specialty starches; starch derivative; and the handling of starches. Included is a glossary of the more unusual technical trade terms used in the text. *National Starch & Chemical Corp.* **L-241**

Poly-Gard Floor Re-Surfacer. Technical data, such as coverage, curing and packaging, on Poly-Gard Floor Re-Surfacer is presented in this four-page folder. Discussed are the materials, chemical, abrasion and impact resistance qualities, as well as its adherence to cement, concrete, metal or wooden floors. *Guardian Industrial Products, Inc.* **L-242**

TECHNOLOGY OF ADHESIVES AT YOUR FINGERTIPS

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Subscribers to ADHESIVES AGE may now obtain, from one central source, technical literature dealing with all aspects of the adhesives industry. One or more of the books listed here may be of invaluable assistance to you. Look this list over and check the books suited to your needs.

- **Adhesive Bonding of Metals—G. Epstein. $2.95.** Considers adhesives used with metals, indicating when an adhesive-bonded joint is advantageous; the type adhesive to use; how to use it, and how to design the joint for optimum performance. ☐

- **Adhesive Bonding of Reinforced Plastics—H. A. Perry. $8.75.** Survey of the design and assembly of structures and products, particularly glass-fiber-reinforced plastic products, by means of adhesives. Gives data on equipment and methods used to produce adhesive bonded joints. ☐

- **Adhesion and Adhesives—N. A. De Bruyne and R. Houwink. $13.50.** A collection of information on the scientific and technological aspects of adhesion. Part I deals with theory, while Part II is devoted to the technology of adhesion. ☐

- **Epoxy Resins—Their Applications and Technology—H. Lee and K. Neville. $8.00.** Guide to the field of epoxy resins, covering the chemistry of their preparation and applications, including a section on adhesives. ☐

- **Polyamide Resins—Donald E. Floyd. $4.50.** Discusses in detail various important applications of the polymers belonging to the polyamide resin family and includes a comprehensive section on adhesives. ☐

- **Principles of High Polymer Theory and Practice—A. X. Schmidt and C. A. Marlies. $13.50.** Study of the principles of high-polymer theory and practice, with a section on adhesives, their applications, and mechanisms and factors involved. ☐

- **Recent Advances in Gelatine and Glue Research—G. Stainsby (Editor). $12.00.** Study of Collagen, and its protein gelatine, comprising papers and Proceedings of an International Conference of the British Gelatine and Glue Research Association. ☐

- **Vinyl Resins—Mayo Smith. $5.75.** Surveys applications of vinyl resins with information on their types, properties, chemistry, manufacture and fabrication. Includes information on several types of adhesives in this category. ☐

- **Epoxy Resins—Irving Skeist. $5.50.** A chapter on adhesives is included in this complete study of the entire field of epoxy resins. The author gives formulations, trade names, methods of manufacture and applications. ☐

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Concrete Adhesives Applications. A 24-page booklet, "Handbook of Application Methods," covers applications of E-Bond #1010 Adhesive with Thiokol polysulfide polymers. The company claims a wide variety of applications due to the strong bond which develops with both cured and new Portland cement concrete. The handbook attempts to indicate these applications and to guide the user in the proper surface preparation and mixing procedure for the adhesive, the equipment required and application procedures. *International Epoxy Corp.* **L-243**

Miccron Powdered Resins. Miccron powdered resins and equipment for fusion coatings are described briefly in a six-page folder. Discussed are the general characteristics of the resins, which are used in a variety of coating applications. The literature includes information on the flocing, flame spraying and fluidized-bed coating processes. Cellulosics, polyesters, nylons, vinyls and epoxies are also covered. *Michigan Chrome & Chemical Co.* **L-244**

Pressure-Sensitive Tapes, Cement. This 16-page brochure, "Stock Items and Allied Products," describes features and applications of pressure-sensitive and self-adherent tapes and high temperature cements. Loose-leaf pages on individual products include specifications. *Connecticut Hard Rubber Co.* **L-245**

Adhesive Plasticizers. A technical bulletin, "Plasticizers in Synthetic-Resin Adhesives," contains data on properties and applications of plasticizers which impart to adhesive formulations such qualities as improved film formation, better tack, faster drying, flexibility and gloss. Six plasticizers approved by the Food and Drug Administration for use in adhesives for food packaging are listed along with detailed information on preservatives, wetting agents, and odorants or masking agents that impart other desired qualities to synthetic resin adhesives. *Monsanto Chemical Co.* **L-246**

Dot-Gummed Label Papers. The literature on Eleet Dot-Gummed label papers discusses six types of papers. The papers are designed for one purpose, to give a smooth surfaced, trouble-free label stock that stores without curling and prints without problems. The data points out that these label papers will not curl because the glue surface allows the paper to expand and contract independently. *Ludlow Papers, Inc.* **L-247**

Foundry Epoxies. Ten applications of epoxies in foundries are outlined in this new three-color, eight-page brochure. Blow core boxes, loose pieces, spotting slugs, match plates, core sticks, cope and drag patterns, fillet pastes and pattern coating resins are a few of the applications described. *Furane Plastics, Inc.* **L-248**

Periodic Table of Elements. The table, which is 62 inches wide and 52 inches high, includes all elements and numbers of naturally occuring radioactive and stable isotopes. Also shown are atomic numbers, weight, density, boiling and melting points, electronic configuration, half-life, and other atomic constants for physics and chemistry. The chart has been reproduced in four colors on heavy plastic coated stock, and comes complete with wood slats at top and bottom as well as eyelets for hanging. *Central Scientific Co.* **L-249**

Epoxy Resin Data Sheets. Literature on Dolphon epoxy resins for electrical insulating uses includes a selection chart, and data sheets. The sheets contain data on one part epoxy resins, two part compounds, pastes, enamel and cement. Described are the physical and electrical properties of the resins, use, pot life and cure. The selection chart lists paste, impregnating, casting and molding, and potting epoxy resins with technical data on each. *John C. Dolph Co.* **L-250**

Automatic Case Gluer. Model CK/AG automatic case gluer, used for gluing top and/or bottom of corrugated shipping cartons, is described in this 2-page sheet. Covered are such data as production rate, glue pots, automatic skip gap, and case sizes. *Crompton & Knowles Packaging Corp.* **L-251**

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In addition to a complete chapter on adhesives, this book provides sound guidance in the important new field of epoxy resins. Subjects covered include:

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BUSINESS OPPORTUNITIES

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in passing

Power of Advertising

Printers' Ink points out that advertising was the recent downfall of a 13-year-old Lancaster, Penna., school girl who spells good, like a school girl should. It happened during a championship spelling bee between a local high school and an elementary school. Asked to spell "wholesome," little Alice Basinger had a quick visual picture, rapidly came out with the letters—"holsum." Alice immediately realized her error, but too late. The judges said, "That's all." Other champions, however, have risen in defense of Alice. One is C. Frank Summy, Jr., president of Gunzenhauser Bakery, Inc. It was the wrapper with which Mr. Summy's firm covers its bread that leaped so quickly into Alice's mind—"Gunzenhauser's Holsum Bread." As a reward for her unwitting aid to "holsum advertising," and to substantiate the claim that Alice's spelling is not without precedent, the bakery presented her with a Webster's Unabridged Dictionary. On page 2,922 of that volume appears "holsum," the middle English form of "wholesome."

Help Wanted

Advertising Requirements points out that its eye was caught by a small ad in a recent issue of *Variety* and couldn't help wondering if this was the start of a new trend. The head, in all caps, read: "Comedians Wanted as Salesmen," and the text went like this: "Only those with great emotional and sincere feelings need apply. Personalities like the greats . . . the real people . . . Alexander King, Jonathan Winters, Oscar Levant, Al Kelly and Fred Lods. Fill in by selling direct to consumers home improvements. Boy, do I need your help! Salary open. Phone AX 1-6353 for appointment."

July, July

The month of July ushers in the so-called "dog days" providing you don't have access to an air conditioner. July also ushers in National Hot Dog Month, National Iced Tea Month and National Picnic Month. Other notable events usually observed in July are: Independence Day, National Safe Boating Week, National Soft Ball Week, Farm Safety Week, Best Invention of the Year Week, Inventors Week, Junior Inventors Week and National Inventors Week.

Reports, Reports

When three autos collided at an intersection in Natick, Mass., recently, the investigating patrolman got a lesson in geography. The accident report read: One car going west on East Central Street; one car going east on West Central Street, and one car going north on South Main Street. No one was hurt, but a compass was needed to complete the report. . . . And then there were two accidents on police blotters last year which were enough to make people wonder if we really were going to the dogs. In two similar mishaps, dogs were "at the wheel" when autos plowed into front porches. In one case, a dog was left in a car with the motor running. In the other instance, the dog released the emergency brake.

Scented Packaging

New packaging allure is now on the market—scented polyethylene. Fragrance Process Co. has developed a resin concentrate with aromas built in. Called Poly-Scent, the concentrate is dry blended with Petrothene, U. S. Industrial Chemical Co.'s film grade resin for extrusion. Texas Plastics of Elsa, Texas, makes the scented film. In Fragrance Process' repertory are aromas of "clean linens" for fresh laundry packages; perfume for packaging lingerie, sweaters, and the like. Tweed, spruce, and similar scents are suggested for men's sport clothing packaging. Candy box overwraps may smell of chocolate and spearmint.

Ruling the Roost

When the Buffalo, N. Y., judge pounded his gavel and said, "$10 or 10 days," the defendant didn't even have to stop and think. The man, who pleaded guilty to public intoxication, said "I'll take the 10 days." He was over-ruled, however, by a "jury of one." His wife slapped down $10, saying "No you don't, I need you at home."

Definitions

High taxation—its fables and foibles—gets the amusing Parkinson treatment in the new book, "The Law and the Profits" by C. Northcote Parkinson with drawings by Robert Osborn (Houghton, Mifflin). New law: "Expenditures rise to meet income."